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Three Essays in Behavioral Economics

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To the Graduate Council:

I am submitting herewith a dissertation written by Patrick McGuire entitled "Three Essays in Behavioral Economics." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Economics.

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Three Essays in Behavioral Economics

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ABSTRACT

My dissertation consists of three essays examining economic decision making with experiments in a variety of competitive and cooperative settings. In the first essay, we examine potential explanations for the phenomenon of overbidding in rent seeking contests by eliciting the smallest share of the prize subjects will accept to avoid it. Our results show that the shares subjects demand are significantly larger than the expected monetary value of the contest, which suggests a stronger preference for costly competition than standard theory assumes. In the second essay, we examine the influence of competitive and earned entitlement on preferences for redistribution. Here we find that subjects are more likely to choose transfers that increase inequality for their reference group in competitive settings when doing so preserves their ordinal rank in the initial earnings distribution. The third essay considers the effect of endowment heterogeneity in a hold-up game conducted in the US and China. Our results show that subjects are more likely choose offers that reimburse their trading partners cost of investment when doing so results in equal payoffs for the pair. We also find significant differences in bargaining behavior with subjects that suggest stronger concerns for reciprocity among subjects in China relative to those in the US, though these differences do not result in greater efficiency.

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CHAPTER I:

OVERBIDDING AND CONTEST AVOIDANCE

ABSTRACT

Overbidding in contests is a well-known finding in laboratory experiments, and numerous theories have been proposed to explain this behavior. Our experimental design implements the strategy method to elicit the smallest share of the prize subjects are willing to accept in lieu of competing for the prize in a winner-take-all rent seeking contest. Although multiple theories such as joy of winning and frustration of losing predict overbidding, they have different predictions for the divisions of the prize that would be acceptable to subjects. We conduct sessions in the US and China and examine behavior within each subject population. Overbidding is observed across both subject populations and the joy of winning emerges as the theory most consistent with the prize divisions that subjects were willing to accept.

1. INTRODUCTION

Competitive rent seeking is ubiquitous, and the inefficiencies associated with it have attracted much attention from researchers (for a review, see Congleton, Hillman & Konrad 2008). Existing literature on this topic is predominantly based on the seminal work of Tullock (1980), in which agents make sunk investments (or 'bids') for a chance to win a monetary prize. Since the very first economic experiments on rent seeking contests (Millner & Pratt 1989; 1991), overbidding has been a persistent phenomenon with total bids across contestants often exceeding the value of the surplus at stake (for a review, see Dechenaux et al. 2015). Such behavior could have significant implications for social welfare, and researchers continue to explore the mechanisms driving this result.

The most common explanations for overbidding in rent seeking contests assume that, relative to standard theory, agents are more inclined towards competition. For example, some argue that overbidding can be explained by assuming contestants experience a non-monetary utility of winning (first proposed by Sheremeta, 2010). Others assume contestants have competitive social preferences or a desire to maximize the difference between their own payoff and their opponent's (Leininger, 2003; Hehenkamp et al., 2004; Herrmann & Orzen 2008).[1]

[1] An extensive literature provides empirical evidence consistent with these assumptions and use either or both theories as a possible explanation for their results (Fonseca et al., 2009; Sheremeta, 2010; Mago et al., 2016; Mago & Sheremeta, 2017).

However, recent work highlights other theories that assume agents are less inclined toward competition as potential explanations for overbidding. For instance, overbidding could be driven by a non-monetary disutility from losing, [2] or it could be driven by an aversion to the disadvantageous inequality one would would experience should they lose.[3] Currently, it remains an open question whether these theories provide a better explanation for overbidding in rent-seeking contests than the joy of winning and competitive social prefereces.

In this paper, we report results from a laboratory experiment designed to address this gap in the literature. We elicit the prize divisions that contestants would accept in favor of competing for the prize in a Tullock contest. The theories proposed to explain overbidding behavior make, in some cases, qualitatively different predictions for agents' willingness to avoid competition preemptively. For example, if agents are more inclined towards competitive settings than standard theory assumes (i.e., utility of winning; competitive social preferences), they will require a larger share of the prize to avoid the contest than standard theory predicts. Conversely, agents less inclined towards competitive settings (i.e., disutility of losing; fairness concerns) will accept a smaller share of the contest prize than standard theory predicts. As a result, these overbidding theories make refutable predictions that can be tested using our experimental design.

To test these predictions, we match each participant with an opponent for a one-shot symmetric two-player game in which they can either share a monetary prize at zero cost or compete for the prize in a winner take all rent seeking contest. The novel feature of our design is that, prior to the contest, we implement a random division of the contest prize that subjects can either accept and avoid the contest or reject and enter the contest. To elicit the prize shares participants are will accept in favor of entering a rent seeking contest, we provide a menu of possible prize divisions and ask participants to state which divisions they are willing to accept and those they would rather reject.

[2] For instance, Sheremeta (2018) notes that a disutility of losing the contest has been used to explain overbidding in variety of competitive settings including first price auctions (Delgado et al., 2008), all-pay auctions (Hyndman et al., 2012), and clock auctions (Cramton et al., 2012), yet remains unexplored in the rent seeking literature.

[3] Hoffmann and Kolmar (2017) show that overbidding in rent seeking contests assumed to be driven by competitive social preferences can also be explained by fairness concerns or an aversion to earning less than one's opponent. Such preferences have been used to explain overbidding in second price auctions (Kimbrough & Riess, 2012), and are associated with higher efforts in tournaments (Balafoutas et al., 2012; Eisenkopf & Teyssier, 2013).

If the participant and their opponent accept the random division, both participants receive their respective share of the prize at zero cost and the game ends. If they do not accept the random division, the contest occurs with each participant paying their desired bid and the monetary prize is assigned to the winner. By implementing our game with the strategy method (Selton, 1967), we elicit from each subject the prize divisions they are willing to accept in the game's first stage and their desired bid for the contest. Because we anticipate overbidding, our primary focus is whether subjects demand a larger or smaller share of the stakes than standard theory predicts.

We conduct our experiment in both the US and China, and test our hypotheses separately using subject data from each country. As such, we can examine whether our results are consistent across populations with salient differences in national culture.[4] Our findings are qualitatively similar for both countries, providing further confidence in our conclusion that the joy of winning is the best explanation for overbidding in contests.[5]

Consistent with previous work, we find that subjects in our experiment bid more than the standard Nash equilibrium prediction. They also demand shares in the first stage that are significantly greater than standard theory predicts. Both of these results are consistent across sessions conducted in the US and China. Additionally, we find that subjects who overbid demand larger shares of the prize than those who don't overbid and a positive correlation between the amount subjects bid and the smallest share they accept, though the significance of these relationships is driven by subjects in our US sessions. Taken together, these results support the claim that behavior in rent seeking contests is driven by an inclination towards competition as opposed to a disutility of losing or disadvantageous inequality aversion.

To examine the extent to which social preferences can explain behavior in our main experiment, we also implement a sequential binary dictator game (Charness & Rabin, 2002) in each session. Here we find that subjects who exhibit competitive social preferences in the

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[4] A large and growing literature examines the influence of national culture on economic decision making (Guiso, Sapienza, & Zingales, 2006; Fernández, 2011), and cultural differences between the US and China are well documented (for examples, see Hoefstede (2001) and Triandis (2018)).

[5] Given the substantial variation in bids observed in experimental rent seeking contests (Sheremeta, 2013), we do not have the statistical power to appropriately address *cross*-cultural differences in contest behavior (power calculations are provided in Appendix C). Thus, we limit our analysis by examining behavior within each subject population and discuss differences between them qualitatively in Section 5.

sequential binary dictator game require a larger share of the prize to avoid the contest, but we fail to detect a significant relationship with bidding behavior. These results suggest that the overbidding we observe may be better explained by the joy of winning as opposed to a desire to earn more than one's opponent.

Though our focus is on testing the various theories of overbidding, our experiment is also related to previous studies on conflict avoidance, where conflict is modeled as a two-player rent seeking contest that subjects can avoid by bargaining over the prize at an earlier stage.[6] Kimbrough and Sheremeta (2013, 2014) and Herbst et al. (2017) each find instances of bargaining failure when standard theory predicts success and substantial overbidding in the subsequent contest. The results from our experiment suggest the mechanisms that drive overbidding in rent seeking contests might also help explain the bargaining failure observed in these settings.

The rest of this chapter is organized as follows. We begin by presenting the theoretical framework of the contest and the game subject's play in our experiment and derive behavioral predictions from theories used to explain overbidding in rent seeking contests. Next we explain our experimental design and procedures in greater detail and derive hypotheses regarding behavior in our experiment. After stating our hypotheses of interest, we report our results. Finally, concludes with a discussion of our results and directions for future research.

2. THEORETICAL FRAMEWORK

In this section, we provide the theoretical foundation for our experimental design and empirical hypotheses. We analyze behavior in a two-player symmetric Tullock (1980) contest under various preference assumptions, and then calculate the shares of the prize that would be preferred to participation in the contest. Each of the non-standard preference specifications imply equilibrium bids in excess of the prediction for a selfish agent. However, their predictions for the share divisions of the prize that would be preferable to participating in the contest differ qualitatively across the theories. These predictions provide refutable hypotheses that we can test in our experiment.

[6] Rent seeking contests are often viewed as a quintessential model of resource wasteful conflict (for a review, see Konrad (2009)).

2.1 Standard Theory

In this section we summarize the results of our baseline model, a simple Tullock contest with risk-neutral agents. Two risk-neutral players compete for a prize of value V. The probability that player i wins the prize depends on i's investment or "bid," denoted by x_i, as well as player j's investment, x_j. Although the contest success function may take many functional forms (Skaperdas, 1996), we focus on the most common specification in which the probability of winning depends on one's bid relative to the sum of bids from both players:

$$(1) \qquad p_i(x_i, x_j) = \begin{cases} \frac{1}{2} & if \quad x_i = x_j = 0 \\ \frac{x_i}{x_i + x_j} & otherwise \end{cases}.$$

Each player's investment is sunk so risk neutral player i's expected utility is given by:

$$(2) \qquad EU_i(x_i, x_j) = p_i(x_i, x_j)(V - x_i) + (1 - p_i(x_i, x_j))(-x_i).$$

Maximizing the above provides best response functions which can then be solved simultaneously to yield the Nash equilibrium bids $x_i^S = \frac{V}{4}$, for $i = 1, 2$. Note that the superscript "S" denotes the bids for a selfish agent. At the equilibrium bids, the expected utility of participating in the contest is

$$(3) \qquad EU_i^S \equiv EU_i(x_i^S, x_j^S) = \frac{V}{4}.$$

The contest is profitable for each player in expectation, but half of the prize value is dissipated by the bids they place. Both players may prefer to share the prize and avoid the contest preemptively. However, mutual acceptance requires each player to receive a share of the prize that yields at least as much utility as they expect from entering the contest. Thus, the minimum acceptable share of the prize (*MAS*) for a selfish agent is $MAS^S = \frac{V}{4}$.

2.2 The Joy of Winning

While standard theory assumes agents only care about monetary payoffs, it has been hypothesized that subjects may also value winning itself. Following Sheremeta (2010), we can incorporate this feature into our model by assuming agents experience an additive non-monetary utility from winning ω such that $\omega > 0$. The expected utility function for a player that experiences a joy of winning in addition to the prize can be written as:

$$(4) \qquad EU_i(x_i, x_j) = p_i(x_i, x_j)(V + \omega - x_i) + (1 - p_i(x_i, x_j))(-x_i).$$

Once again, it is straightforward to solve for the Nash equilibrium bids

$$(5) \qquad x_i^{\omega} = \frac{V+\omega}{4}, \text{ for } i = 1, 2.$$

and the corresponding expected utility of participating in the contest,

$$(6) \qquad EU_i^{\omega} \equiv EU_i(x_i^{\omega}, x_j^{\omega}) = \frac{V+\omega}{4}.$$

Equation (6) shows that despite its positive effect on wasteful equilibrium bids, player *i's* expected utility of entering the contest increases when subjects receive a joy from winning. Thus, *the joy of winning* predicts the minimum acceptable share of the prize is $MAS^{\omega} = \frac{V+\omega}{4}$, which is greater than the amount for selfish agents.

2.3 The Frustration of Losing

In the previous section we considered the possibility that agents' value winning itself. Economists and others have also considered the possibility that agents experience disutility from losing beyond the monetary loss of the agent's bid (Delgado, et al 2008). We incorporate this feature into our model by assuming agents experience an additive non-monetary disutility from losing the contest, $\lambda > 0$, such that $\lambda > 0$. The expected utility for a contest player with these preferences is

$$(7) \quad EU_i(x_i, x_j) = p_i(x_i, x_j)(V - x_i) + (1 - p_i(x_i, x_j))(-x_i - \lambda).$$

Solving as before for the Nash equilibrium bids we get

$$(8) \quad x_i^{\lambda} = \frac{V+\lambda}{4}, \text{ for } i = 1, 2.$$

Hence, as with the joy of winning, subjects are predicted to bid more aggressively when they receive a non-monetary disutility from losing. Assuming equilibrium behavior, the expected utility from participating in the contest is

(9) $$EU_i^{\lambda} \equiv EU_i(x_i^{\lambda}, x_j^{\lambda}) = \frac{V-3\lambda}{4}.$$

The above shows that player *i's* expected utility from participating in the contest is less than the expected monetary payoff of $\frac{V}{4}$. Thus, *the frustration of losing* predicts that each player's minimum acceptable share of the prize $MAS^{\lambda} = \frac{V-3\lambda}{4}$, less than predicted by standard theory.

2.4 Competitive and Prosocial Preferences

Several studies suggest that overbidding in rent seeking contests may be driven by competitive social preferences (Leininger 2003; Mago et al. 2016;). Following a similar method to Mago et al. (2016), we can incorporate this feature into our model by assuming the utility of player *i* to be

(10) $$U_i(\pi_i, \pi_j) = \pi_i(x_i, x_j) + \rho\pi_j(x_j, x_i),$$

where π_i is player i's own payoff, π_j is the payoff of their opponent, and ρ is a relative payoff parameter such that $1 > \rho \geq -1$.[7] If $\rho < 0$, player *i* is a competitive agent that seeks to increase the difference between their own payoff relative to their opponent's. If $\rho > 0$, player *i* is considered to have a *prosocial* preference for efficiency and is more inclined towards increasing their opponents' payoff than a selfish agent.

Solving as before for the Nash equilibrium bids we get

(11) $$x_i^{\rho} = \frac{V(1-\rho)}{4}, \text{ for } i = 1, 2.$$

[7] To model behavior in contests with more than two players, Mago et al., (2016) model utility as a function of an agent's own pay out and the weighted average of payouts for the entire group. Their final bid function is qualitatively similar to the one we derive.

Thus competitive subjects ($\rho < 0$) are predicted to overbid relative to a selfish agent ($\rho = 0$) and prosocial subjects ($\rho > 0$) are predicted to underbid. Assuming equilibrium behavior, the expected utility from participating in the contest is

$$(12) \qquad EU_i^\rho \equiv EU_i\left(x_i^\rho, x_j^\rho\right) = \frac{V(1+\rho)^2}{4}.$$

The above shows that a competitive player *i's* expected utility from participating in the contest is greater than an expected monetary payoff of $\frac{V}{4}$, while that of a prosocial player *i* is less than this amount. These preferences will also affect player *i*'s utility from sharing the prize. If we assume the agents begin with identical endowments, consistent with our experimental design, *i*'s utility from receiving share $\sigma_i \in [0,1]$ of the prize is

$$(13) \qquad U_i(\sigma_i V, (1-\sigma_i)V) = \sigma_i V + \rho(1-\sigma_i)V.$$

By setting EU_i^ρ equal to (13), we can solve for an agent's minimum acceptable share of the prize:

$$(14) \qquad MAS^\rho = \frac{V(1-\rho)}{4}.$$

In equation (14), we can see that competitive (prosocial, resp.) subjects are predicted to have a *MAS* that is greater (less, resp.) than $\frac{V}{4}$.

2.5 Fairness

Several studies suggest that contest behavior may be driven by fairness concerns (Eisenkopf & Teyssier, 2013; Herrmann & Orzen, 2008; Hoffmann & Kolmar, 2017). In the presence of uncertainty, such concerns can be modeled in one of two ways. Here we consider a *consequentialist* approach in which agents only care about the fairness of *ex post* payoffs. An alternate *procedural* approach is to hypothesize that agents have preferences over *ex ante* payoffs. We focus on the former because the latter does not yield clear predictions due to multiple equilibria "around" the selfish equilibrium (see Trautmann, 2009).

To incorporate fairness concerns into our theoretical framework we use the preference specification proposed by Fehr and Schmidt (1999) and then take expectations in accordance with the contest. Specifically, let the utility function for a player *i* be given by

$$U_i = \pi_i - \alpha \max\{\pi_j - \pi_i, 0\} - \beta \max\{\pi_i - \pi_j, 0\}. \tag{15}$$

where π_i and π_j denote players' final monetary payoffs. The coefficient $\alpha \geq 0$ determines the disutility experienced from disadvantageous inequality, and coefficient $\beta \geq 0$ determines the disutility experienced from advantageous inequality. Following Fehr and Schmidt (1999), we assume that player *i* suffers weakly more from disadvantageous inequality than from advantageous inequality ($\alpha \geq \beta$), and that player *i* would not be willing to burn their own money for the sake of reducing advantageous inequality ($\beta < 1$).

Assume that winning (losing, resp.) the contest leaves player *i* ahead of (behind, resp.) player *j*, as must be true for all bids in the "vicinity" of a symmetric equilibrium. The expected utility for player *i* can then be written as

$$\begin{aligned} EU_i(x_i, x_j) = {} & p_i(x_i, x_j)\left(V - x_i - \beta(V - x_i + x_j)\right) \\ & + (1 - p_i(x_i, x_j))\left(-x_i - \alpha(V + x_i - x_j)\right). \end{aligned} \tag{16}$$

By differentiating (14) and solving best response functions simultaneously, we can derive the symmetric equilibrium bid for the contest:

$$x_i^{EP} = \frac{1+\alpha-\beta}{4+2\alpha-2\beta}V \quad \text{for} \quad i = 1, 2. \tag{17}$$

Algebra confirms that $x_i^{EP} > V/4$ for $\alpha > \beta$ and $x_i^{EP} = V/4$ for $\alpha = \beta$. Thus, inequality aversion implies a deviation from selfish behavior only if agents are more averse to disadvantageous inequality than they are to advantageous inequality, which is a common assumption in models using Fehr-Schmidt preferences.

The expected utility of participating in the contest is calculated by taking expectations of player *i*'s utility conditional on equilibrium behavior:

$$EU_i^{EP} \equiv EU_i(x_i^{EP}, x_j^{EP}) = \frac{V}{2}\left(\frac{1}{2+\alpha-\beta} - \alpha - \beta\right). \tag{18}$$

It follows that the expected utility of participating in the contest for an *ex post* inequality averse agent is less than that of a selfish agent. Inequality preferences will also affect player *i*'s utility from sharing the prize. If we assume the agents begin with identical endowments, consistent with our experimental design, i's utility from receiving share $\sigma_i \in [0,1]$ of the prize is

(19) $$U_i(\sigma_i V, (1-\sigma_i)V) = V\sigma_i - VMax\{\alpha(1-2\sigma_i), \beta(2\sigma_i - 1)\}.$$

Since $U_i(\sigma_i V, (1-\sigma_i)V)$ is increasing in σ_i on the interval [0,½) and $U_i\left(\frac{V}{2}, \frac{V}{2}\right) > EU_i^{EP}$, it follows that an agent's minimum acceptable share is less than $\frac{1}{2}$.[8] By setting $EU_i^{EP} = V\sigma_i - V\alpha(1-2\sigma_i)$ we can solve for an agent's minimum acceptable share of the prize:

(20) $$MAS^{EP} = \frac{(1+\alpha-\beta)^2}{2(1+2\alpha)(2+\alpha-\beta)}V.$$

The above is less than the selfish minimum acceptable share $V/4$, which is intuitive since inequality averse subjects bid (weakly) more than selfish subjects and end up with unequal outcomes.

3. EXPERIMENTAL DESIGN AND HYPOTHESES

The multiplicity of behavioral theories consistent with overbidding is something of an embarrassment of riches. The predicted bids from each theory being a function of unobservable preference parameters, so it is not possible to refute one of the theories using only contest (bid) data, without refuting all of them. However, because these theories have qualitatively different predictions for the divisions of the prize that would be preferred by subjects to competing for the prize, we construct refutable hypotheses that relates the minimum acceptable shares to subjects' bidding behavior. This allows us to distinguish overbidding driven by, for example, an inclination towards competition as opposed to a disutility of losing or disadvantageous inequality aversion by determining which motive can rationalize the data along both dimensions.

To this end, our experimental design utilizes the strategy method to elicit subjects' willingness to accept various divisions of the prize rather than compete in a Tullock contest.We then elicit social preferences in a subsequent task to identify subjects that exhibit competitive,

[8] It is also easy to see verify than all shares greater than MAS^{EA} must yield greater utility than participating in the contest.

pro-social, or inequality averse preferences. In our analysis, we can use this information to examine whether differences in social preferences can help us explain our results from the main experiment.

In addition, we collect data from two culturally distinct subject populations. Experiment sessions were conducted at the University of Tennessee (Knoxville, TN) as well as Southwest Petroleum University (Chengdu, China). As such, we can explore whether our findings are robust across various culturally diverse subject populations.

3.1 Design and Procedures

We recruited 116 subjects from undergraduate classes in a variety of disciplines at both the UT (56 subjects) and SWPU (60 subjects). Hard copies of the instructions were provided at each location and the experiment was computerized using the Ztree software (Fischbacher, 2007). At UT the hard copy instructions and Ztree screens were in English while at SWPU they were in Mandarin. Each session took approximately 30 minutes to complete, and average participant earnings were $10.90 (USD).

Each session began with a reading of the instructions and time set aside for questions if needed. Then, similar to Herbst et al. (2017), subjects took part in a learning stage for the contest. Using their mouse and keyboard, participants could set hypothetical bids for themselves and their opponent to observe how different combinations of bids influenced probabilities and outcomes.[9]

Once the learning stage was complete, participants were informed that they would receive an endowment of 125 ECU (experimental currency units) and would be randomly and anonymously matched with another participant in the session. Participants were informed that they and their "match" would individually decide which divisions of a 100 ECU would be acceptable. For each of the 17 possible divisions (see Table B.1 in Appendix B), participants were required to either "accept" or "reject" the division. Once these decisions were made, the computer would randomly select a division for each pair of subjects. If both participants in a given pair chose to

[9] Learnings stage bids were set using scroll bars in the Z-tree software. Win/Loss probabilities were displayed numerically and visually using pie graphs. Their associated outcomes are presented in a table, providing the earnings for each player contingent on winning and losing. For more details, see Figure A.1 in the appendix.

accept the randomly selected prize division, the game would end, and each participant received their respective share of the prize at zero cost.

If either one or both players in a pair rejected the division chosen by the computer, neither participant received their respective share and the pair participated in a winner take all contest. The contest prize was set at 100 ECU and proceeded in standard fashion. Participants simultaneously chose their respective bids and the computer chose a winner using a probability distribution endogenously determined by their respective bids. The prize was assigned to the winner and the loser received nothing, while both players paid their bids.

Before the game was implemented participants submitted all decisions using the strategy method, stating the prize divisions they were willing to accept and their desired bid for the contest if the randomly selected prize division was rejected by either participant. The menu of 17 possible surplus distributions that the computer could select was provided in their instructions, along with examples of the two decision forms they would later fill out on their computer screen (see example instructions in Appendix D). After reading the instructions, the experimenter allowed time for questions before subjects submitted any decisions that might affect earnings.

On the first decision screen, subjects stated whether they would be willing to accept or reject each of the 17 possible divisions (for a screenshot, see Figure B.1 in Appendix B). Once all participants submitted these decisions, the second decision screen appeared. On the second decision screen, subjects chose their desired bid for the contest if the randomly selected prize division was rejected (for a screenshot, see Figure B.2 in Appendix B).

Once all participants made their decisions, the computer implemented the game by randomly selecting a prize division for each pair. If both players had chosen to accept this division, the game ended with each participant receiving a payoff equal to their 125 ECU endowment and their respective share of the contest prize. If either or both participants rejected this division, neither participant received their respective share and the contest was implemented. Both participants received their 125 ECU endowment less their respective bids, and the randomly chosen winner additionally received the 100 ECU prize.

After the main portion of the experiment, we elicited risk preferences from subjects using a lottery task first implemented in Eckel and Grossman (2008). Subjects were required to choose from a menu of six possible lotteries. Each option offers a 50% chance of receiving a high or low payout, and subjects select a single lottery to determine their earnings for the task. Table B.1 in our appendix shows the decision form for this task, along with the degree of constant relative risk aversion associated with each lottery. Following Eckel and Grossman (2008), we classify subjects who chose lotteries 1-4 as *Risk Averse*.

Once the lottery task was complete, subjects were randomly and anonymously sorted into new pairs for a sequential dichotomous dictator game similar to the one implemented in Charness and Rabin (2002).[10] Each subject made six decisions regarding the payout their partner would receive, while their own payoff remained constant. Once subjects submitted their decisions, the computer randomly selected one subject from each pair and randomly implemented one of their six decisions to determine payouts for the task.

Table B.2 in the appendix shows the decision for this task as well as the responses from subjects in each location. There you can see that each decision entails a dichotomous choice between equal and unequal payoffs for the pair. The first three choices offer the deciding player an opportunity to decrease their partner's payoff below their own payoff, while the last three decisions offer the deciding player an opportunity to decrease their partner's payoff below their own.

Because a player with competitive social preferences (as described in Section 2.4) would always choose the lowest payoff for their partner, we classify subjects that choose Option B for decisions 1-3 and Option A for decision 4-6 as *Competitive*. Since this behavior describes only a small proportion of subjects in our sample (approximately 18%), we broaden our measurement of competitive social preference with an additional indicator for *Weakly Competitive* social preferences. This category includes subjects that chose Option A for decisions 4-6 (i.e. subjects that refused to increase their partners payoff above their own) and Option B for decisions 1, 2 or 3 (i.e. subjects that chose to decrease their partners payoff below their own at least once). We will use these measures in our analysis.

[10] Subjects were informed that they would not be matched with the same partner as in the contest.

At the end of the experiment, participants filled out a demographic questionnaire. Following the questionnaire, the computer displayed outcomes from each part of the experiment and calculated individual earnings. Participants received their payments in private and in cash before leaving the lab.

3.2 Hypotheses

This section describes hypotheses derived from the theories presented in Section 2. In order for one or more of these theories to be consistent with the data it must rationalize not only the observed bidding behavior but also subjects' willingness to share the prize. We begin with our predictions for bidding behavior summarized by Hypothesis 1. Since many of the theoretical "point predictions" depend on unobservable preference parameters, our hypotheses relate bids to the selfish prediction. Recall that the prize was set at 100 in the experiment, implying an equilibrium bid for a selfish agent equal to 25 (= $V/4$).

Hypothesis 1A. (Standard Theory, Ex Post Inequality Aversion with $\alpha=\beta$):
Subjects will bid 25 in the contest.

Hypothesis 1B. (Joy of Winning, Frustration of Losing, Competitive Social Preferences, Ex Post Inequality Aversion with $\alpha>\beta$):
Subjects will bid greater than 25 in the contest.

Our second hypothesis involves subjects' acceptances or rejections of various divisions of the prize. Just as we cannot make point predictions with regard to bids, unless agents have standard risk neutral preferences, so too we cannot predict a subject's willingness to accept each possible division of the prize. However, it is possible to make predictions for specific divisions of the prize, conditioned on the behavioral theory being postulated. For example, if a subject's bidding behavior is driven by the *Joy of Winning* or *Competitive Social Preferences,* these theories predict that they would rather enter the contest than accept a 25 ECU share of the prize (or less). Conversely, if a subject's bidding behavior is driven by the *Frustration of Losing* or *Ex Post Inequality Aversion,* theory predicts that they would accept a 25 ECU share of the prize (or greater) to avoid entering the contest. We summarize these predictions in Hypothesis 2.

Hypothesis 2A. (Standard Theory):
Subjects will accept (reject, resp.) all shares to greater (less, resp.) than 25 ECU.

Hypothesis 2B. (Joy of Winning, Competitive Social Preferences):
Subjects will reject shares that are less than or equal to 25 ECU.

Hypothesis 2C. (Frustration of Losing, Ex Post Inequality Aversion, Prosocial Preferences):
Subjects will accept shares that are greater than or equal to 25 ECU.

If a subject accepts a share of 25, this allows us to reject Hypothesis 2B (*Joy of Winning, Competitive Social Preferences*). However, if a subject rejects a share of 30, this behavior allows us to reject Hypothesis 2A (Standard *Theory*) and 2C *(Frustration of Losing and Ex Post Inequality Aversion*), but not Hypothesis 2B.

In addition to the hypotheses above, we can also consider the continuous analog of our second hypothesis which would predict the minimum acceptable share (MAS) to be greater than, equal to, or less than 25 (depending on the theory under consideration). Although our design does not allow us to directly observe subjects' MAS, we do observe the smallest share accepted by each subject from our menu of prize divisions (see Figure A.1 in Appendix A). We can use these decisions in an interval regression to estimate each subject's MAS, test whether it is greater or less 25,[11] and examine its relationship with subsequent decisions in the experiment (ex. bids, lottery task, and the sequential binary dictator game).

4. RESULTS

We begin this section by testing our hypotheses regarding bids and acceptable prize shares in sections 4.1 and 4.2, respectively. We nexttake a closer look at the observed behavior in Section 4.3 by examining the proportion of subjects who overbid that demand shares of the contest prize consistent with each theory. Then we use regression analysis in Section 4.4 to test whether competitive social preferences in the sequential binary dictator game can explain bidding behavior, and whether variation in subjects' minimimum acceptable share can be explained by the preferences we elicit, bidding behavior, and other demographic controls.

[11] This is essentially a continuous version of our test for Hypothesis 2.

4.1 Bids

As is often the case in experimental rent-seeking contests, we find substantial variation in bids for the contest across individuals. Figure A.1 plots the cumulative distribution of bids in each location. Here we can see that more than half of the subjects in both the US and China overbid and that the range of bids chosen span the strategy space. Table A.1 reports the mean bid in each location.

Finding 1: Average bids are significantly greater than 25 in both US and China sessions.

The average bids for the US and China sessions were 34.80 and 42.25, respectively. Using a Wilcoxon signed-rank test, we find that bids are significantly greater than the standard risk neutral prediction of 25 ECU in both the US (p-value = 0.000) and China (p-value = 0.000). Additionally, using a t-test, we find that the mean bid in each location was significantly greater than 25 ECU (p-value = 0.000). This finding is consistent with the literature on experimental rent seeking contests and allows to reject Hypothesis 1A in support of the other theories of overbidding (Hypothesis 1B).

4.2 Acceptable Shares

Figure A.2 plots acceptance rates for each sample population across the set of possible surplus divisions the computer could select. Here we can see a downward trend in acceptance as the subject's own share fall below the 50 ECU. Figure 2 shows that acceptance rates for both samples are greater than 50% for shares greater than or equal to 40 ECU and fall below 50% for each share less than or equal to 35 ECU.

In Table A.2, we report acceptance rates for each division of the surplus (along with their 95% confidence intervals) for our US and China Sessions. Here we can see that only 12.5% of subjects in the US and 18.3% of subjects in China were willing to accept a share of 25 to avoid the contest. Additionally, results from a binomial test indicate that the proportion of those that rejected the split is significantly larger than the proportion of those that accept it when their own share less than or equal to 35 in both locations. These results are inconsistent with Hypothesis 2.A and Hypothesis 2.C, and provides strong support for Hypothesis 2.B.

Another way to test Hypothesis 2 is to find the smallest share of the prize each subject accepted to avoid the contest and compare the amount predicted by standard theory. Figure A.3 plots the distribution the smallest share accepted (*SSA*) by each subject across locations, and we report means for this measure across locations in Table A.3. Here we can see that the smallest share of the prize accepted by subjects in each location is significantly greater than 25 (both Wilcoxon signed-rank p-values <0.0001). In fact, a Wilcoxon signed-rank test rejects the null hypotheses that either *SSA* is less than or equal to 30 at the 0.1% level (both US and China p-values < 0.0005).

Finding 2: Rejection rates for shares of 35 or less are significantly greater than 50% in both US and China sessions, and the smallest share accepted by subjects was significantly greater than 30. These results contradict the frustration of losing and inequality aversion, and provide support for the joy of winning and competitive social preferences.

Findings 2 and 3 allow us to reject Hypothesis 2A (Selfish) and Hypothesis 2C (Frustration of Losing, Inequality Aversion, Prosocial Preferences), but are consistent with Hypothesis 2B (Joy of Winning, Competitive Social Preferences). Since the joy of winning and competitive social preferences can explain each of our findings, they provide a better explanation for overbidding in rent seeking contest than the frustration of losing and inequality aversion. In either case, it appears that overbidding is associated with an inclination towards costly competition and away from efficiency.

4.3 Bidding and Competitive Social Preferences

To shed more light on the findings above, we examine the degree to overbidding may be associated with competitive social preferences using characteristics elicited at later stages of each session. Our measures for competitive social preferences are derived using subjects' responses in the sequential binary dictator game to classify subjects as *Competitive* and/or *Weakly Competitive* (as described in Section 3.1). Sample proportions for these variables and other individual specific characteristics can be found in Table A.4.

In Tables A.5 and A.6, we compare average bids and rates of overbidding across social preference categories for subjects in US and China sessions, respectively. We compare mean bids across social preference categories with two-sample *t*-tests and fail to detect a significant difference for either competitiveness measure in either location (all p-values >0.699). Then, using a two-sample Fisher's exact test of proportions, we find that the same is true for the rate of overbidding (all two-sample Fisher's exact p-values > 0.342). To examine this relationship further, we employ regression analysis to see if risk preferences and gender effects might be confounding our results.

We report results from linear regressions with *Bid* as the dependent variable in Table A.7. Here we can see that none of the estimated coefficents associated with *Competitive* or *Weakly Competitive* are statistically significant (all p-values > 0.589). The only significant variable in Table A.6 is *Risk Averse*, which indicate that risk averse subjects, on average, bid significantly less than others (both p-values <0.056). However, our results indicate that competitive social preferences were not significant in determining average bids.

The linear regression results reported in Table A.8 are derived from similar models as those discussed above, but we use a dummy variable for subjects that *Overbid* on the left hand side of each specification. Here we find similar results in that none of the estimated coefficents associated with *Competitive* or *Weakly Competitive* are significant (all p-values > 0.686), which tells us that subjects with competitive social preferences overbid at a similar rate to others. We summarize these results below, in Finding 3.

Finding 3: Subjects with competitive social preferences do not bid more than others.

From this we can conclude that competitive social preferences do not explain overbidding in our experiment. Thus, joy of winning remains as the only theory of overbidding that can explain our results.

4.4 Bids and Acceptable Shares

Now that the joy of winning has emerged as the theory most consistent with behavior in our experiment, we consider the relationship between the smallest share subjects accepted and their bid for the contest. Figure A.4 provides a two-way scatter plot with *Bid* on the horizontal axis and *Smallest Share Accepted* on the vertical axis. It shows that, of the 66 subjects that overbid in our experiment, only 1 subject in the US and 5 subjects in China required a share of the prize to avoid the contest that is less than or equal to the amount standard theory predicts. As reported in Table A.9, this means that 96.7% of overbidding subjects in the US and 86.1% of overbidding subjects in China demand more than a 25 ECU share to avoid the contest. Thus, it appears that the vast majority of subjects who overbid demand a share of the prize consistent with the joy of winning.

In Tables A.10 and A.11, we futher examine the relatiohship between the smallest share subjects accepted and their bid for the contest in each location, respectively. Each table reports a Spearman's correlation matrices with *SSA, Bid* and a dummy variable *Overbid* set equal to one if a subjects bid weas greater than 25 ECU. For US subjects, we find a positive and significant correlation between the smallest share a subject chose to accept with their *Bid* (p-value = 0.073), and we find a positive and significant correlation between *Smallest Share Accepted* and *Overbid.* These results suggest that higher bids are associated with demanding a larger share of the prize to avoid the contest among US subjects, and that US subjects that overbid demand larger shares of the prize than those who do not overbid.

In Table A.11, we can see that the signs of our correlation coefficients calculated for subjects in China are similar to those found for US subjects, although niether of these coefficients are statistically significant (both p-values > 0.364). However, if we pool the data across locations, we do find a positive and significant correlation between *SSA* and *Overbid* (p-value = 0.046).[12] The correlation coefficient between *SSA* and *Bid* is also positive but marginally insiginificant (p-value = 0.114). Thus, it appears that subecjts who overbid require larger shares of the prize to avoid the contest than those who do not overbid. This contradicts the frustration of losing and inequality aversion as explanations of overbidding in rent seeking contests, and provides additional support for the joy of winning.

To shed more light on this relationship, we can treat *Smallest Share Accepted* as a censored dependent variable and estimate their minimum acceptable share (*MAS*) with subjects' accet/reject decision using an interval regression. From each subject we obtain signals $c_{i,u} \geq MAS_i \geq c_{i,l}$ where $c_{i,u}$ is the smallest share accepted and $c_{i,l}$ is the next smallest amount. If the

[12] The correlation matrix using pooled data can be found in Table A.12.

subject accepts the lowest amount available (10 ECU), $c_{i,l} = -\infty$.[13, 14] We assume MAS_i to be a linear function of a row vector of covariates, $\boldsymbol{x_i}$, such that $MAS_i = \boldsymbol{x_i \gamma} + \varepsilon_i$, where $\boldsymbol{\gamma}$ is a column vector of unknown parameters and ε_i is a normally distributed mean-zero error term with standard deviation σ_i. With the linear conditional mean function, assuming the error term has a normal distribution is analogous to assuming a normal distribution for MAS_i . Additionally, the interpretation of estimated parameters is the same as for a standard linear regression model that treats MAS_i as a directly observed. Thus, the log likelihood function for our interval regression is

$$(1)\ \ln L = \sum_i^N \ln(\Phi\left(\frac{c_{i,u} - \boldsymbol{x_i \gamma}}{\sigma_i}\right) - \Phi\left(\frac{c_{i,l} - \boldsymbol{x_i \gamma}}{\sigma_i}\right)),$$

where Φ is that standard cumulative normal distribution.

To allow for this possibility across subjects in the US and China, we define $\sigma_i = \sigma_0 + China * \sigma_1$. Table A.13 reports our regression results. Estimates for the error coefficient associated with the US and $China$ are provided in the bottom rows of each regression table and are statistically significant at the 1% level across model specifications.

Specification [1] of Table A.13 estimates a significant positive relationship between *Bid* and *MAS* (p-value = 0.051) which contradicts the frustration of losing and inequality aversion. In Specification [2], we build upon Specification [1] by including indicator variables for risk preferences, competitive social preferences, and gender. Here we find that the coefficient associated with *Bid* remains positive but becomes marginally insignificant when additional control variables are included (p-value = 0.141). Nevertheless, these results are inconsistent with the frustration of losing and inequality aversion as explanations of overbidding in rent-seeking contests which predict a negative relationship between bids and *MAS*.

Specifications [3] and [4] replace *Bid* with the indicator variable *Overbid* to estimate the mean difference in *MAS* between subjects who overbid and those who do not. Here we find that subjects who overbid have a larger *MAS* and this difference is significant at the 1% level (p-value = 0.005), and in Specification [4] we find that this difference is robust to controls for risk

[13] The frustration of losing and inequality aversion suggest that MAS_i could be negative.

[14] Because each subject in our sample accepted at least one of the available prize divisions, we can ignore the case in which $c_{i,u}$ may be greater than 90 ECU.

aversion, competitive social preferences, and gender (p-value = 0.004). These results not only contradict the frustration of losing and inequality aversion, but provide additional support for the joy of winning.

5. Cross Country Comparisons

Although we do not have sufficient statistical power to appropriately address hypothesis tests across locations, we do observe some differences in behavior that are worthy of discussion. First, as shown in Table A.1, the average bid for subjects in our China sessions was approximately 7.55 ECU higher than the average bid in our US sessions. While we fail to detect a significant differences in either means (p-value = 0.141) or medians (Wilcoxon rank-sum p-value = 0.128), this may only be due to our lack of power. To our knowledge, no study has yet compared bidding behavior in rent seeking contests across countries with significant differences in national culture. Future research in this area could provide some interesting insights into cultural difderences in competitive behavior.

In addition, although the average *MAS* was similar across locations,[15] we did detect differences in acceptance rates across locations for some of the prize divisions subjects could accept to avoid the contest. Specifically, we found that subjects in our China sessions were less likely to accept splits for which their own share was 55, 50, or 45.[16] These results suggest that a larger proportion of subjects in China prefer costly competition to a relatively fair division of the prize at stake. [17]

6. CONCLUSION

A consistent finding in the large literature on contests is that subjects overbid relative to the Nash prediction. Considering this observation, researchers have provided explanations that typically rely on non-standard utility specifications. However, since the implied equilibrium bids ultimately depend on unobservable preference parameters, it is difficult to use bidding behavior

[15] See the rightmost column of Table A.3.

[16] In Table A.2, we report p-values from Fisher's exact tests of proportions comparing acceptance rates for each prize divisions across locations. The p-value associated with these divsions were less than 0.032 in each case.

[17] We should also note that subjects in China were significantly more likely to exhibit *Competitive* (p-value = 0.028) and *Weakly Compeitive* (p-value = 0.086) social preferences in the sequential binary dictator game. However, as noted above, we do not have sufficient power to address differences in proportions across locations.

to choose between the theories. Our experiment has taken a different approach by eliciting subjects' willingness to share the prize rather than compete for it.

Consistent with the joy of winning and competitive social preferences, we observe both overbidding, average demanded shares in excesss of the amount predicted by standard theory, and a positive correlation between overbidding and the smallest share accepted to avoid the contest. Additionally, we fail to detect a significant relationship between competitive social preferences in the sequential binary dictator game and bids. This suggests that the joy of winning provides the best explanation for overbidding in our experiment.

Whereas most contest experiments recruit subjects from the US, our study considers the behavior of subjects in both China and the US. We observe overbidding and larger demanded shares of the prize to avoid the contest in both locations. As such, we provide evidence of the cross-cultural robustness of overbidding in rent seeking contests in a way that is consistent with the Joy of Winning.

In addition to testing our main hypothesis of interest, the elicitation mechanism we use can easily be extended to other versions of Tullock's (1980) model commonly explored in the literature. For example, the elicitation mechanism can examine behavior in contests with asymmetric cost functions, asymmetric prizes, minimum bid requirements, or endogenous rents. Contests between groups have also received considerable attention from the literature (for a review, see Sheremeta 2018), and one can examine behavior in these settings by augmenting the elicitation mechanism with a voting rule. Additionally, introducing a third party to the game whose payoff depends on contest expenditures can reframe the game's first stage to examine collusive behavior. We leave these questions for future research.

APPENDIX A: TABLES AND FIGURES

Table A.1: Bids

	US [N=56]	China [N=60]	H_0: US = China
Avg. Bid (ECU)	34.80	42.25	*p-value* = 0.128
	(3.54)	(3.55)	

Notes: Mean bids are reported for our US and China samples, respectively. The reported p-value is derived from a two-sample Mann-Whitey rank-sum test with the null hypothesis that bids are equal across countries. (Standard Errors are reported in parenthesis).

Table A.2: Acceptance Rates

Shares		US			China			H_0: US = China
Own	Match	%Accept	Std. Err.	Bi-test	%Accept	Std. Err.	Bi-test	p-value
90	10	91.1	3.8	96.4	83.3	4.8	90.7	0.215
85	15	89.3	4.1	95.2	83.3	4.8	90.7	0.353
80	20	89.3	4.1	95.2	83.3	4.8	90.7	0.353
75	25	87.5	4.4	94.0	86.7	4.4	93.2	0.894
70	30	92.9	3.4	97.5	90.0	3.9	95.6	0.584
65	35	91.1	3.8	96.4	91.7	3.6	96.7	0.909
60	40	96.4	2.5	99.4	90.0	3.9	95.6	0.172
55	45	94.6	3.0	98.5	81.7	5.0	89.4	0.032
50	50	94.6	3.0	98.5	76.7	5.5	85.3	0.006
45	55	83.9	4.9	91.4	65.0	6.2	75.2	0.020
40	60	73.2	5.9	82.7	60.0	6.3	70.7	0.132
35	65	30.4	6.1	42.0	38.3	6.3	49.8	0.366
30	70	16.1	4.9	26.4	25.0	5.6	35.9	0.236
25	75	12.5	4.4	22.2	18.3	5.0	28.5	0.386
20	80	14.3	4.7	24.3	15.0	4.6	24.7	0.913
15	85	8.9	3.8	17.9	15.0	4.6	24.7	0.316
10	90	8.9	3.8	17.9	15.0	4.6	24.7	0.316

Notes: We report acceptance rates (%Accept) for each possible prize division using all observations from our US and China samples. Values reported in columns labeled “Bi-test” are derived from one-tail binomial tests and signify the smallest AR we can reject at the 5% level. Reported *p*-values in the right most column are derived from two-sample Fisher’s exact tests of proportions with the null hypothesis of equality across countries.

Table A.3: Smallest Share Accepted

	US	China	H_0: US = China
Smallest Share Accepted	37.1	38.7	
H_0: Mean ≤ 30	*p-value* = 0.000	*p-value* = 0.000	*p-value* = 0.386

Notes: The p-values reported below "Smallest Share Accepted" are derived from Wilcoxon signed rank tests. The rightmost column contains p-values comparing each variable across locations using a two-sample Mann-Whitney rank sum test.

Table A.4: Demographics (Essay 1)

	US	China	Ho: US = China
Risk Averse	0.75	0.733	*p-value* = 0.838
Competitive	0.107	0.267	*p-value* = 0.028
Weakly Competitive	0.179	0.317	*p-value* = 0.086
Male	0.6	0.5	*p-value* = 0.282

Notes: In the right most column, we report *p*-values from two-sample Fisher's exact tests of proportions.

Table A.5: Comparing Competitive and Noncompetitive Subjects (US Sessions)

	Bid	%Overbid
Competitive = 1	33.50	50.0
= 0	34.96	54.0
	p-value = 0.901	*p-value* = 0.852
Weakly Competitive = 1	31.40	40.0
= 0	35.54	56.6
	p-value = 0.699	*p-value* = 0.342

Notes: Reported p-values refer to hypothesis test comparing variables across categories with equality as the null. The p-values associated with "Bid" are derived from Welch's *t*-tests. The p-values associated with "%Overbid" are derived from two-sample Fisher's exact tests of proportions.

Table A.6: Comparing Competitive and Noncompetitive Subjects (China Sessions)

	Bid	%Overbid
Competitive = 1	40.7	61.4
= 0	42.8	56.2
	p-value = 0.788	*p-value* = 0.702
Weakly Competitive = 1	47.6	58.5
= 0	39.8	63.2
	p-value = 0. 387	*p-value* = 0.734

Notes: Reported p-values refer to hypothesis test comparing variables across categories with equality as the null. The p-values associated with "Bid" are derived from Welch's *t*-tests. The p-values associated with "%Overbid" are derived from two-sample Fisher's exact tests of proportions.

Table A.7: Bid Regressions

	[1]	[2]	[3]	[4]
Comp.	-1.92	-2.85		
	(6.56)	(6.64)		
Weakly Comp.			3.17	2.69
			(5.88)	(6.04)
Risk Averse		-11.16**		-11.23**
		(5.8)		(5.8)
Male		-5.39		-4.35
		(5.23)		(5.29)
China	7.75	7.23	7.01	6.5
	(5.15)	(5.11)	(5.1)	(5.07)
Constant	35.01***	46.66***	34.24***	45.31***
	(3.69)	(6.9)	(3.77)	(7.1)

Notes: Standard-Errors reported in parentheses. p-value < 0.1*, 0.05**, 0.01***.

Table A.8: Overbid Regressions

	[1]	[2]	[3]	[4]
Competitive	-0.048	-0.056		
	(0.121)	(0.124)		
Weakly Competitive			-0.036	-0.044
			(0.109)	(0.113)
Risk Averse		-0.094		-0.093
		(0.109)		(0.109)
Male		-0.048		-0.049
		(0.098)		(0.099)
China	0.072	0.067	0.069	0.064
	(0.095)	(0.096)	(0.094)	(0.095)
Constant	0.541***	0.641***	0.542***	0.642***
	(0.068)	(0.129)	(0.07)	(0.131)

Notes: Standard-Errors reported in parentheses. p-value < 0.1*, 0.05**, 0.01***.

Table A.9: Smallest Accepted Shares if Bid > 25 (66 obs.)

Location	Obs.	% SSA > 25	% SSA ≤ 25
US	30	96.67	3.33
		(3.28)	(3.28)
China	36	86.11	13.89
		(5.76)	(5.76)

Notes: Standard errors are reported in parenthesis.

Table A.10: Spearman's Correlation Matrix (US Sessions)

	1	2	3
1. Smallest Share Accepted	-		
	-		
2. Bid	0.240*	-	
	(0.073)	-	
3. Overbid	0.306**	0.867***	-
	(0.030)	(0.000)	-

Notes: The p-values for each coefficient are reported in parentheses. Asterisks indicate significance (p-value < 0.1*, < 0.05**, < 0.01***)

Table A.11: Spearman's Correlation Matrix (China Sessions)

	1	2	3
1. Smallest Share Accepted	-		
	-		
2. Bid	0.078	-	
	(0.554)	-	
3. Overbid	0.118	0.860	-
	(0.364)	(0.000)	-

Notes: The p-values for each coefficient are reported in parentheses. Asterisks indicate significance (p-value < 0.1^{*}, < 0.05^{**}, < 0.01^{***})

Table A.12: Spearman's Correlation Matrix (Pooled)

	1	2	3
1. Smallest Share Accepted	-		
	-		
2. Bid	0.148	-	
	(0.114)	-	
3. Overbid	0.185^{**}	0.860	-
	(0.046)	(0.000)	-

Notes: The p-values for each coefficient are reported in parentheses. Asterisks indicate significance (p-value < 0.1^{*}, < 0.05^{**}, < 0.01^{***})

Table A.13: Interval Regressions on MAS

	[1]	[2]	[3]	[4]
Bid	0.09*	0.07		
	(0.05)	(0.05)		
Overbid			7.05***	6.86***
			(2.51)	(2.38)
Weakly Competitive		7.89**		8.39**
		(3.03)		(2.95)
Risk Averse		-6.77**		-6.96**
		(2.88)		(2.76)
Male		2.12		1.98
		(2.59)		(2.49)
China		-0.53		-0.55
		(2.61)		(2.55)
Constant	31.31***	34.45***	30.83***	33.36***
	(2.18)	(3.95)	(1.88)	(3.53)
Natural log of the Standard Error Function (σ)				
China	0.4***	0.38**	0.42***	0.42***
	(0.15)	(0.15)	(0.15)	(0.15)
Constant	2.43***	2.4***	2.39***	2.34***
	(0.1)	(0.11)	(0.1)	(0.1)

Notes: Standard-Errors reported in parentheses. p-value < 0.1*, 0.05**, 0.01***.

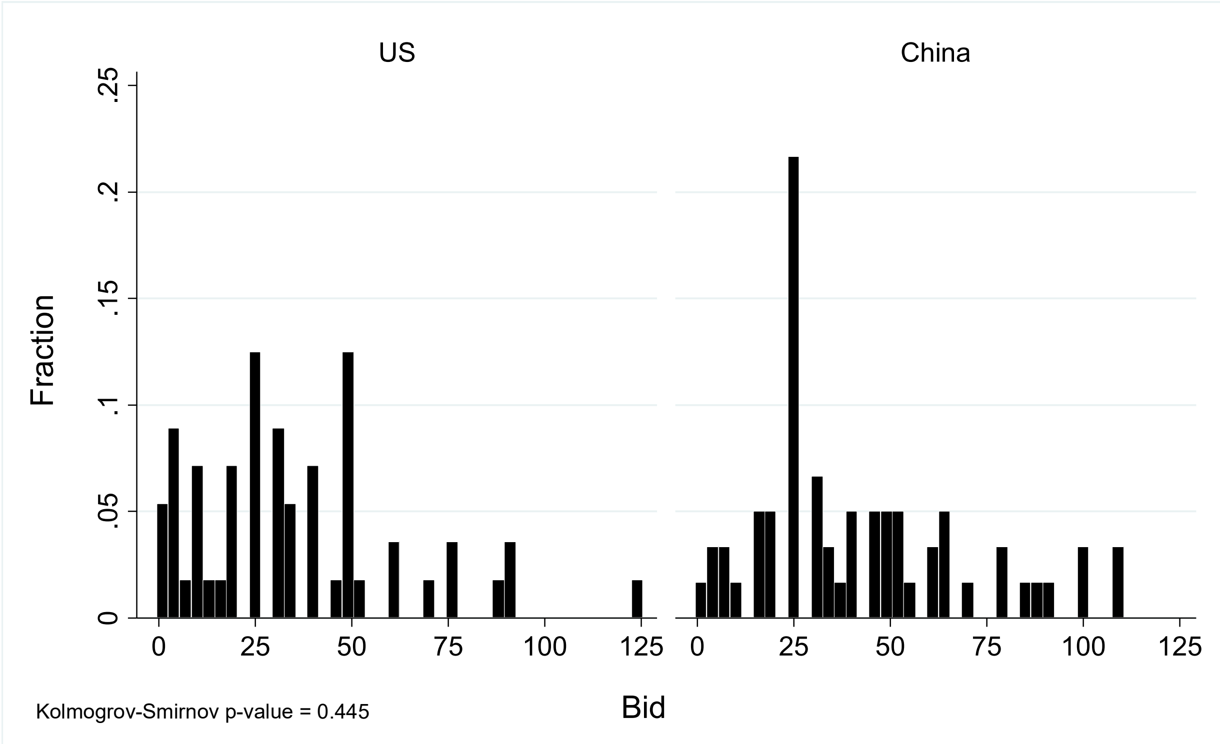


Figure A.1: Bid (Histogram)

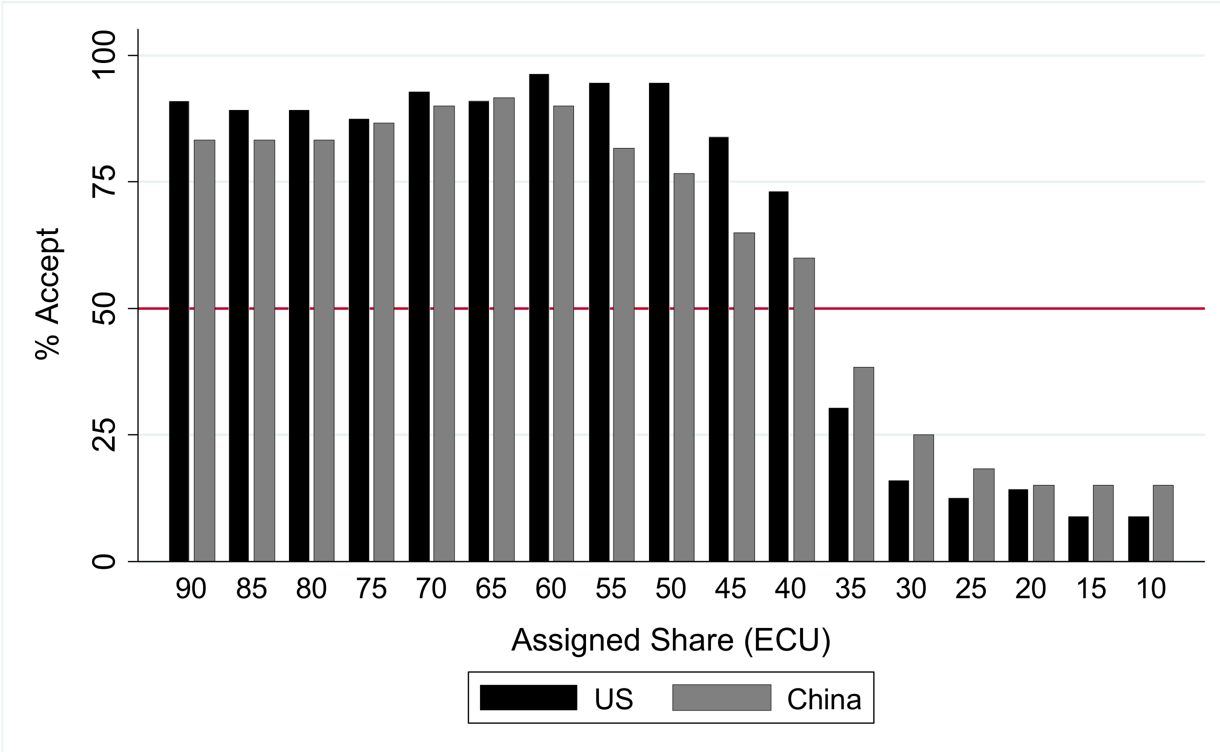


Figure A.2: Acceptance Rates (Histogram)

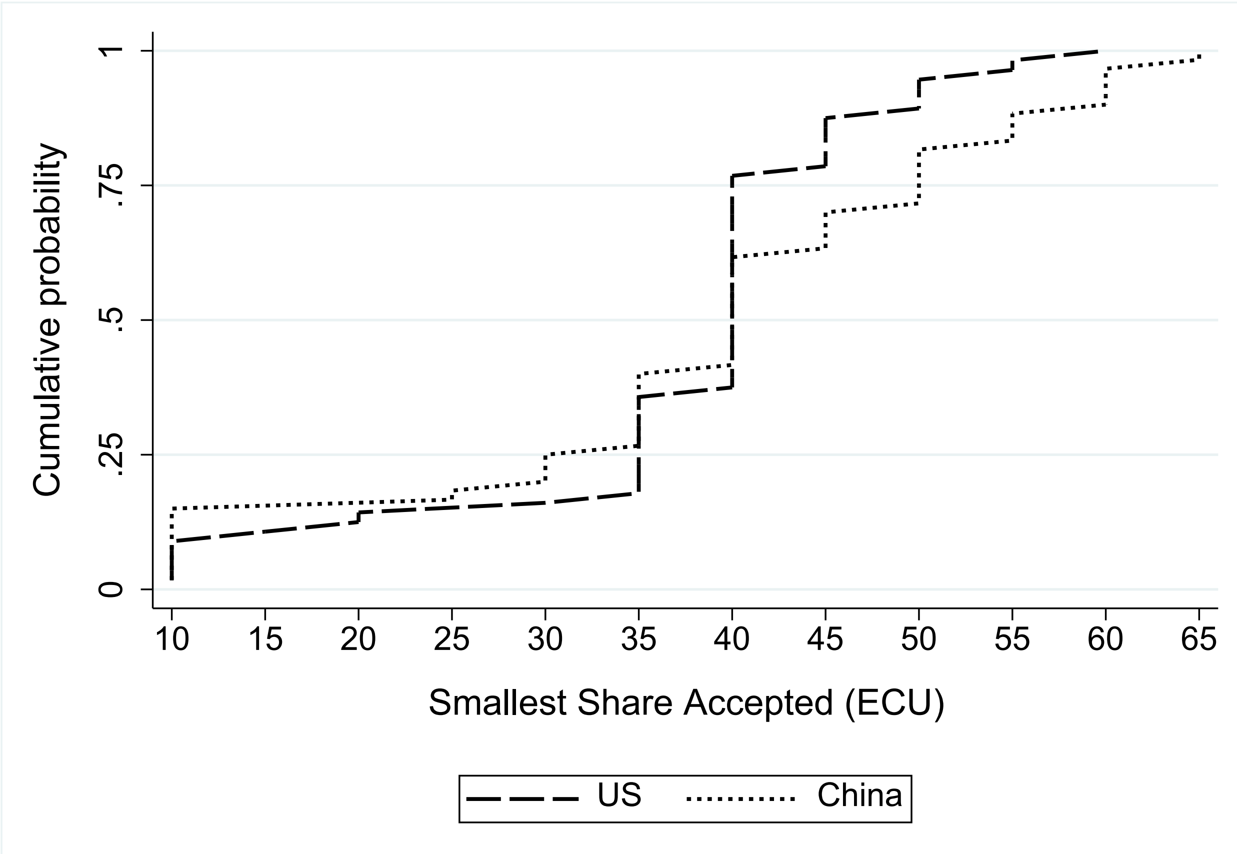


Figure A.3: Smallest Share Accepted (Distribution Plot)

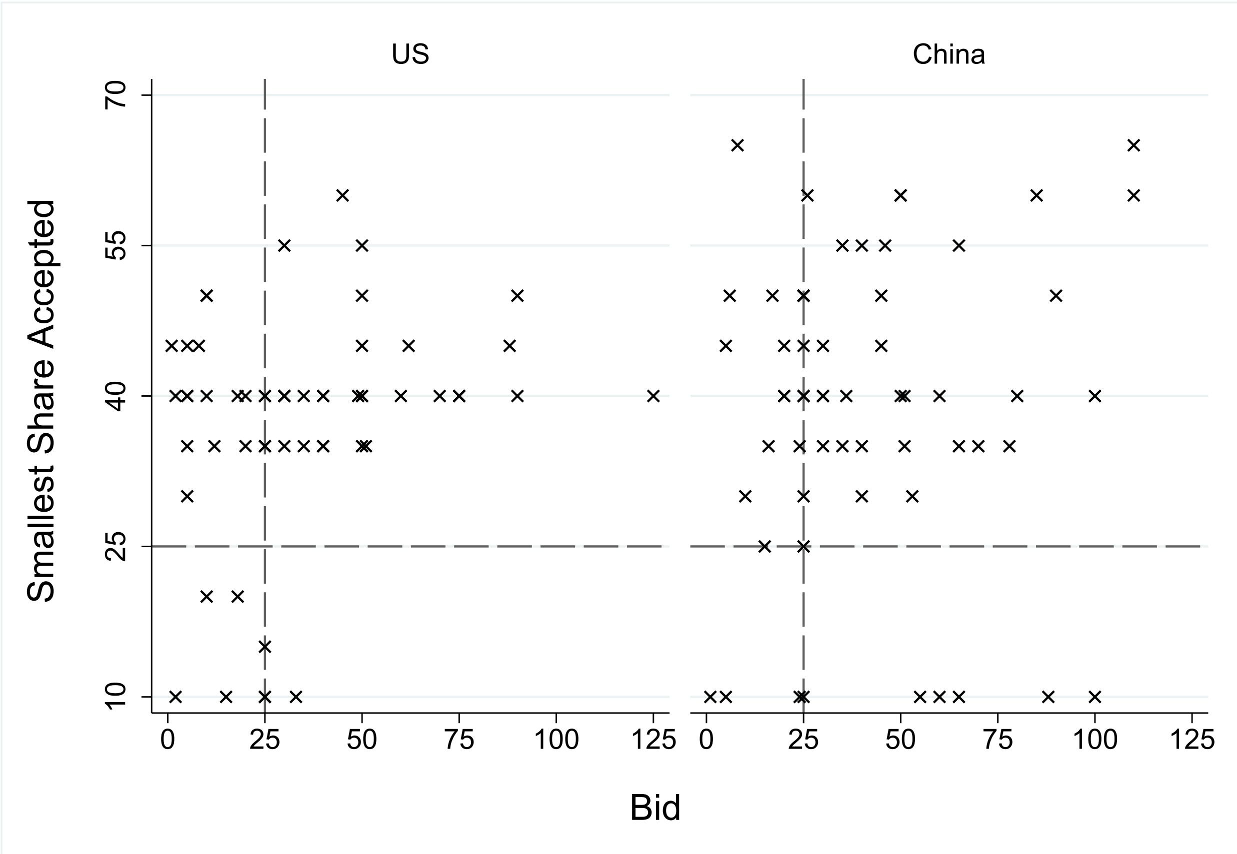


Figure A.4: Bids and Smallest Share Accepted (Scatter Plot)

APPENDIX B: ADDITIONAL TABLES AND FIGURES

Table B.1: Prize Divisions

Share 1	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
Share 2	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90

Notes: Above, we provide the set of possible prize divisions measured in experimental currency units (ECU).

Table B.2: Risk Elicitation (Essay 1)

Lottery Number	High Payoff (ECU)	Low Payoff (ECU)	Chances (High, Low)	US (%)	China (%)
1	56	56	(50%, 50 %)	1.8	1.7
2	72	48	(50%, 50 %)	14.3	20.0
3	88	40	(50%, 50 %)	30.4	28.3
4	104	32	(50%, 50 %)	28.6	23.3
5	120	24	(50%, 50 %)	16.1	16.7
6	140	4	(50%, 50 %)	8.9	10.0

Notes: Subjects were instructed to choose 1 of the 6 lotteries listed above. The degree of constant relative risk aversion (CRRA) associated with each lottery is as follows: [Lottery 1 | 3.46 < r], [Lottery 2 | 1.16 < r < 3.46], [Lottery 3 | 0.71 < r < 0.16], Lottery 4 | 0.50 < r , 0.71], Lottery 5 | 0 < r < 0.50], [Lottery 6 | r < 0]. Variable '*Risk Averse*' = 1 if Lottery 1, 2, 3, or 4 was chosen.

Table B.3: Social Preference Elicitation (Essay 1)

Decision Number	Option A (Self, Other)	Option B (Self, Other)	US (% Option B)	China (% Option B)
1	(48, 48)	(48, 24)	16.1	35.0
2	(48, 48)	(48, 32)	23.2	40.0
3	(48, 48)	(48, 40)	23.2	53.3
4	(48, 48)	(48, 56)	64.3	40.0
5	(48, 48)	(48, 64)	60.7	28.3
6	(48, 48)	(48, 72)	58.9	25.0

Notes: Subjects were instructed to state whether you prefer Option A or Option B for each row. Variable '*Competitive*' = 1 if the subjects chose Option B for Decisions 1-3 and Option A for Decisions 4-6. Variable '*Weakly Competitive*' = 1 if the subjects chose Option A for Decisions 4-6 and Option B for Decisions 1, 2, or 3.

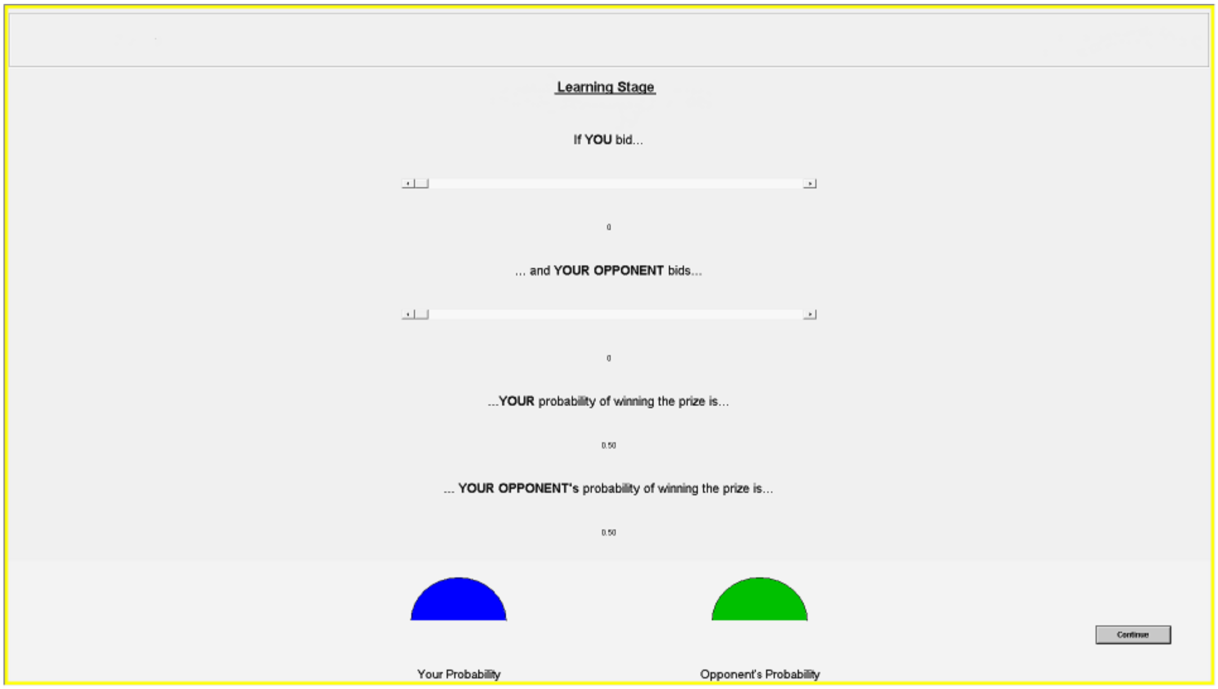


Figure B.1: Learning Stage

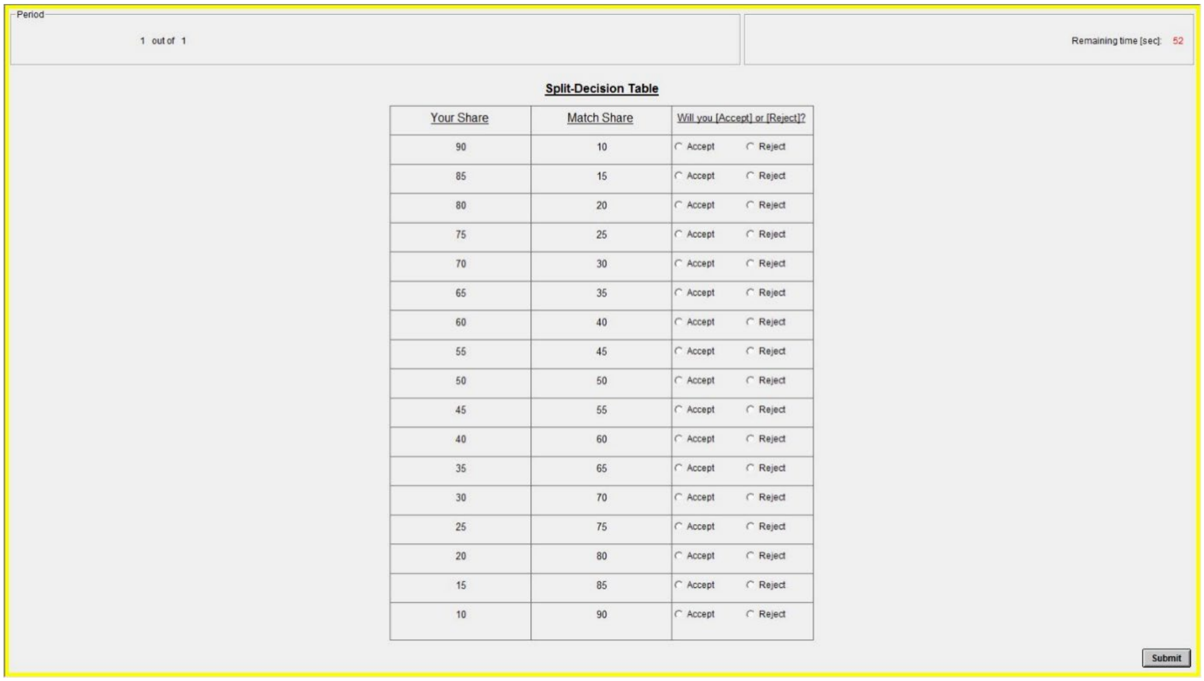


Figure B.2: First Decision Screen

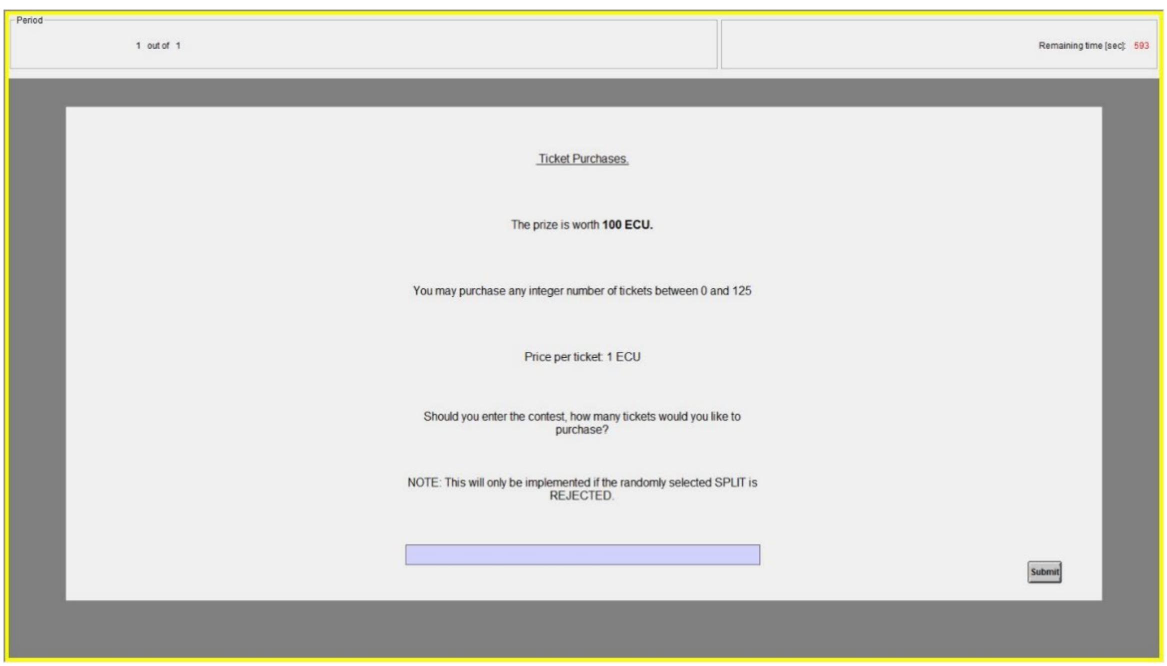


Figure B.3: Second Decision Screen

APPENDIX C: POWER ANALYSIS

Mean Bids Across Locations

Using results from Sheremeta (2013)'s survey, we estimate that average bids in a contest with 2 symmetric players and a $5 prize to be approximately 38 ECU (or 52% greater than the Nash prediction). While standard deviations are not reported in this survey, from studies similar to our own we find that the standard deviation of bids in a symmetric 2-player rent seeking contest is approximately equal to the Nash predicted bid (Kimbrough and Sheremeta, 2013; Herman and Orzen 2008; Fonseca, 2009; Chowdhury and Sheremeta, 2014). Finally, we take the size of our samples from the US (N_U = 56) and China (N_c = 60) as given.

Assuming a US sample mean bid of $\overline{x_U} = 38$ and a common sample standard deviation of $\hat{\sigma} = 25$, we find that the minimum detectable difference in mean bids across locations with 80% power is approximately 13 ECU. This difference is rather large, considering that it could imply either a mean bid consistent with the Nash prediction in China or total rent dissipation. Additionally, to detect a difference of 10 ECU with 80% power we would need a total sample size of approximately 200. Thus, we relegate differences in bids across locations to a lower status in our analysis.

Acceptance Rates Across Locations

Unlike bids in rent seeking contest, we do not have a clear reference point from prior studies with which to base our assumed acceptance rate for the control group. However, we can use the predicted acceptance rate of 50% from standard theory to estimate the minimum detectable difference in acceptance rates for a share of 25 ECU.

Given the size of our samples from the US (N_U = 56) and China (N_c = 60) and assuming an acceptance rate in the US consistent with standard theory $\overline{AR_U} = 50\%$, the minimum detectable difference with 80% power is approximately 26.5%.[1] Additionally, to detect a difference of 20% with 80% power we would need a total sample size of approximately 212. Thus, we relegate differences in acceptance rates across locations to a lower status in our analysis.

[1] This is the minimum detectable difference if one uses a two-sample Fisher's exact test of proportions.

CHAPTER II:

HOW DID WE GET HERE? THE EFFECTS OF EARNED INCOME AND COMPETITION ON PREFERENCES FOR REDISTRIBUTION

ABSTRACT

In this paper, we examine the influence of earned entitlement on preferences for redistribution by implementing the redistribution game from Kuziemko et al. (2014) in settings where the initial distribution of payouts is determined by either (1) a random lottery, or (2) performance in a competitive task. Using responses from our post experiment questionnaire, we also find that this behavior is strongly correlated conservative opinions regarding the Federal Minimum Wage and Conscientiousness (as measured by the BFI-44) in both competitive and random rank settings. Our results shed some light on factors that influence preferences for redistribution, and how earned entitlement may affect trade-offs between equity and ordinal rank.

1. INTRODUCTION

In recent years, preferences for income redistribution have received much attention from experimental economists (Fehr & Schmidt, 1999; Bolton & Ockenfels, 2000; Charness & Rabin, 2002; Engelmann & Strobel , 2004; 2007). A common theme found in this literature is that individuals typically exhibit preferences consistent with the prioritarian view (Parfit, 1997), choosing to help those worse off than themselves or worse off than others whom they have an opportunity to help.

A clear example of such behavior can be found in Kuziemko et al., (2014), who conducted a modified dictator game (referred to as, “the redistribution game”) in which subjects are randomly assigned rank ordered payoffs and then tasked with distributing a bonus payment to one of the two players nearest to themselves in the earnings distribution. The authors find that subjects overwhelmingly chose to help the player with a smaller initial payoff, even when doing so reduced the choosing player’s ordinal rank in pay. However, it remains an open question whether this result persists if the earnings distribution is determined by a competitive process based on effort or skill as opposed to pure chance.

In this paper, we report results from a laboratory experiment in which subjects take part in the Redistribution Game from Kuziemko et al. (2014) under a variety of conditions. Using a within-subjects design, we vary the process that determines the initial payoff distribution across competitive and non-competitive (or random-rank) settings. Our goal is to test whether the presence of competition will diminish subjects' willingness to sacrifice their rank in pay to reduce inequality.

This study builds upon a large and growing literature focused on the various underlying processes determining income distributions and how they impact preferences regarding changes in the distribution. Currently, there is abundant evidence from field data that supports this hypothesis. For instance, a number of studies analyze survey data, finding a populations' desired level of progressive taxation/redistribution is strongly correlated with the degree in which the population believes the initial distribution to be determined by luck as opposed to effort or merit (Alesina & Angeletos, 2005; Alesina & Giuliano, 2011; Alesina, Cozzi & Mantovan, 2012; Clark & D'Ambrosio, 2015). Meanwhile, preferences for redistribution when outcomes are determined by innate ability tend to fall somewhere in between those of effort and luck (Leventhal & Michaels, 1971; Rest et al., 1973; Isaksson & Lindskog, 2009).

Existing theories in this field relate notions of fairness to agents' social preferences for redistribution (Roemer, 1998; Konow 2000). For example, the accountability principle, as defined by Konow (2000), states that perceptions of fairness with respect to the income distribution vary in proportion to the degree in which discretionary variables, at the individual level, determine outcomes. In this utility framework, effort is viewed as being discretionary while innate ability is viewed as nondiscretionary. Konow (2000) reports results from a set of laboratory experiments in which unequal endowments as well as player roles were determined by subjects' performance in a series of tasks. While reported results support their predictions regarding the influence of earned entitlement on social preferences, their predicted difference between the effect of effort and innate ability was not confirmed. Similar results are also found in Oxoby and Spraggon (2008) as well as Iida (2015), in that subject behavior is similar across distribution determined by real-effort and innate ability.

Other experimental inquiries into the influence of earned entitlement do so using two-player bargaining games (Cherry et al 2002; Hoffman and Spitzer, 1985; Hoffman et al., 1994; Ruffle 1998). A considerable difference in the present study is that subjects in our experiment make decisions affecting the earnings distribution within a larger reference group which allows us to examine symmetric behavior at various points along the earnings distribution.

Experiments with larger reference groups find that earned entitlement decreases concerns for inequality using public choice mechanisms (Durante, Putterman & Van der Weele, 2014; Krawczyk, 2010), augmented dictator games (Barr, Burns, Miller & Shaw, 2015; Erkal, Gangadharan & Nikiforakis, 2011; Riyanto & Zhang 2013), and an augmented moon lighting game (Fehr, 2018). However, all the experiments thus far mentioned provide subjects with a choice set in which one's own earnings, total earnings for the reference group, and one's share of total group earnings vary across the available alternatives. In the redistribution game, each of these cardinal measures are invariant to the subject's choice. This allows us to isolate changes in ordinal rank, equity, and priority. Nevertheless, if earned entitlement diminishes the importance of inequality in subjects' preference evaluations, this could have a negative effect on their likelihood of choosing a lower ranked player in our competitive settings.

Another strand of literature related to our experiment examines how the presence of competition can trigger envy or spite among those who perform poorly towards those who were more successful. For example, Chowdhury & Gürtler (2015) shows that poor contest performers are those most likely to engage in sabotage, while top performers are those most targeted. Additionally, Jauernig et al. (2016) allows subjects to punish each other after outcomes are determined, finding substantial money burning and spiteful behavior in the absence of strategic concerns. Like the studies mentioned previously, subjects' decisions in Jauernig et al. (2016) and the experiments surveyed in Chowdhury & Gürtler (2015) influence own earnings, total group earnings for the reference group, and one's share of group earnings which differs significantly from our decision setting. However, if competitive situations trigger envy or spite, the presence of competition may further repel subjects from rewarding a player that outperformed themselves.

In our analysis, we find that subjects choose the lower ranked player approximately 70% of the time. We also find that this tendency decreases in the presence of competition, and that this difference is significant among ranks in which subjects must sacrifice their ordinal position in the earnings distribution to help the lower ranked player. These results provide further support for the priority view of income redistribution, though this preference is slightly diminished when one's position in the payoff distribution is earned.

In our post experiment questionnaire, we elicit information regarding subjects' political affiliations and opinions regarding specific public policies to see how these characteristics relate to behavior in our decision setting. When we include these responses into our analysis, we find subjects with conservative opinions regarding the minimum wage to be significantly less likely to choose the lower ranked player than others with more progressive views. This difference is robust to a battery of regressions that include controls for political party affiliation and gender.

These results are similar to those in previous experiments, finding political preferences to coincide with 'behavioral types' (Durante et al., 2014). We also argue that this result is of particular importance given that increasing the Federal Minimum Wage (a commonly considered public policy proposal in the United States to address growing income inequality) is an egalitarian public policy with salient negative effects on the ordinal position of those near the bottom of the income distribution. Our results provide additional support for the claim that opposition to an increase in the Federal Minimum Wage is driven, at least in part, by an aversion to these adverse effects that are often ignored by researchers in other disciplines (Kuziemko et al., 2014).

The remainder of this paper is organized as follows: Section 2 provides a detailed description of the redistribution game. Section 3 explains the design of our experiment, summarizes salient behavioral predictions from models of inequality aversion and lists our main hypotheses of interest. Section 4 reports the main results from our experiment testing the hypotheses listed in Section 3. In Section 5, we use responses from our post experiment questionnaire to examine individual specific heterogeneity in behavior and relate it to the relevant literature. Section 6 concludes.

2. THE REDISTRIBUTION GAME

The standard version of the redistribution game begins with subjects (sorted into groups of 6) being randomly assigned rank ordered payouts to establish an initial distribution of payoffs. The player ranked 1st receives \$6, the player ranked 2nd receives \$5, and payoffs continue to decline in \$1 increments over ranks with the player ranked 6th (last) receives \$1. Once the initial distribution of payoffs is determined, ranks and initial payoffs of each player for the current round are common knowledge.

Then each player must then give one of the two players closest to themselves in the earnings distribution a $2 bonus payment provided by the experimenter. This means that the player ranked first must choose between giving $2 to either the 2nd or 3rd ranked player, the player ranked last must choose between giving $2 to either the 4th or 5th ranked player, and each player ranked 2nd through 5th must choose between giving the player ranked directly above or below them an additional $2. [1]

No matter their rank in the initial earnings distribution, choosing the player ranked directly below oneself will always result in greater payoff inequality for the group. Given that rank ordered payoffs are separated by $1 increments, choosing the player directly below oneself also results in a drop-in rank for the choosing player. Thus, players ranked 2^{nd}-5^{th} face a trade-off between reducing inequality and preserving their initial rank in the payoff distribution.

After players make their decisions, one player is randomly chosen and his choice determines the final payoffs of that round. As such, players should make their decisions as if they alone will determine the final distribution of the round. To avoid any reciprocity effects, players do not know which player is chosen or the final outcome of the round when making their allocation choice. After the end of each round, players are randomly sorted into new groups of six, players within each group are rerandomized across the same rank ordered payoff distribution and the game repeats. Earnings from the game are determined by their final balances for one randomly chosen round.

3. EXPERIMENTAL DESIGN AND HYPOTHESES

Using a within-subjects design, we implement the redistribution game under three conditions in each session using z-Tree (Fischbacher, 2007). The first condition is identical to the standard version of the redistribution game with rank ordered payouts being randomly assigned. In the remaining two conditions, ranks are determined in competitive settings based on performance in either a real-effort task with slider- bars (Gill & Prowse, 2012) or a mental rotation task (Vandenberg & Kuse, 1978).

[1] Choice sets for each rank are summarized in Table D.1.

Apart from the mechanism determining the initial distribution of payouts, the redistribution game is played identically across conditions. Each session had of three stages of play (one for each condition),[2] and stages consisted of 8 (or 9) rounds with the last 7 being eligible to impact earnings. In the text that follows, we describe each of the competitive tasks and experiment procedures in greater detail before deriving our main hypotheses of interest.

3.1 Effort Task

To examine the influence of competition in which effort plays a primary role in determining outcomes, we use a computerized real effort task with slider-bars, first seen in Gill and Prowse (2012). Subjects are presented with a screen consisting of 48 slider bars. Figure D.1 provides an example of a slider-bar and screenshots of the interactive screen players used to complete the task.

The position of the slider is associated with a number between 0 and 100, inclusive. For each slider placed in the center of its respective bar, subjects receive 1 point. In each round of play, subjects were given 60 seconds to score as many points as they could with a timer provided in the top right corner of their screen. When the timer reached zero, the program progressed automatically to the redistribution game. Rank ordered payouts were determined by subject scores, from highest to lowest. Once each subject submitted their allocation decision, subjects were randomly sorted into new 6 player groups and the game repeats.

3.2 Ability Task

To examine the influence of competition in which innate ability plays a primary role in determining outcomes, we use a computerized mental rotation task originally designed by Vandenberg and Kuse (1978). The task is commonly used to measure spatial intelligence which is strongly correlated with general intelligence. presents subjects with images of three-dimensional. An example of the mental rotation problems that subjects were asked to complete can be seen in the Figure D.2.

[2] The order in which random-rank, effort and ability task conditions were implemented was randomized across sessions. A summary of treatments can be found in Table D.2.

As you can see, on the left-hand side of the screen subjects are provided with one image of a "reference object" and four other images on the right-hand side of the screen which we call their "Choice Set". In each choice set, two of the images provided are reflections or enantiomorphs of the reference object and the two that remain are identical to the reference object but rotated to some degree. To score, subject must correctly identify at least one of the images in the choice set that are identical to the reference object. Subjects may either find one of the two identical objects and score 1 point, or find both and score 2 points. However, to minimize the scope for randomness, if a player identifies an object in the choice set as an identical to the reference object, and this is not the case, they receive 0 points for their response.

In each round of play, subjects had 6 image sets and 90 seconds to complete them. Subjects were allowed to skip back and forth through their 6-image set, as they would be able to in a paper version of the same task. Subjects were provided with a 90 second timer in the top right corner of their screen, and when the timer reached zero, the program automatically progressed to the redistribution game. Rank ordered payouts were determined by subject scores, from highest to lowest, and a subject's own score was provided on their decision screen for the redistribution game. Once each subject submitted their allocation decision, subjects were randomly sorted into new 6 player groups and the game repeats.

3.3 Procedures

All sessions of the experiment were conducted at the Economics Experimental Laboratory at the University of Tennessee during the summer and fall semesters of 2015. Each session took approximately 70 minutes to complete. Subjects were recruited from large lecture halls during introductory undergraduate courses at the University of Tennessee. All subjects in the pool have voluntarily registered to participate in economics experiments via the online registration site (https://utk-econlab.sona-systems.com). Sessions were conducted with at most 24 and as few as 12 participants. Our data set contains 5,412 observations from 222 participants. Slightly more than 40% of our subjects were female.

Earnings from each session were determined by randomly selecting one round in each stage to be played out for payment. Participants were not informed of the round chosen from any of the three stages until the experiment was complete. With the addition of a $5 show up fee, participants earned an average of \$16.50 in each session. Across all sessions, participants earned as little as \$8.00 and as much as \$27.00.

At the beginning of each session, we informed participants of our lab's basic protocols. Then, we read aloud the instructions consistent across rounds and stages. Participants knew that they could leave the experiment at any time if they so wished, though none left before the conclusion of their session. Each stage of the experiment was preceded by a public reading of the instructions specific to the stage. Participants were not informed of the number of stages, nor the types of tasks they would be asked to complete in subsequent stages.

3.4 Predictions from Models of Inequality Aversion

Before we discuss our main hypothesis of interest, it is important to note that accepted models of inequality aversion either make no clear prediction or suggest that people prefer to give to the lower-ranked player. For instance, the model of inequality aversion proposed by Fehr and Schmidt (1999) posits that utility for an individual with a payoff x_i in a distribution of x_1, x_2, … x_N can be written as

$$u_i(x_i, x_{j\neq i}) = x_i - \frac{\alpha}{n-1}\sum_{j\neq i}^{n-1} \mathrm{Max}[x_j - x_i, 0] - \frac{\beta}{n-1}\sum_{j\neq i}^{n-1} \mathrm{Max}[x_i - x_j, 0]$$

where the parameter $\alpha > 0$ measures the marginal disutility associated with disadvantageous inequality, while the parameter $\beta \geq 0$ measures the marginal disutility associated with advantageous inequality such that $\alpha \geq \beta$.

In this utility framework, players ranked 2nd-5th face a symmetric choice in utility terms. Choosing the higher ranked player will increase disadvantageous inequality by two units, while choosing the lower ranked player will (i) increase disadvantageous by one unit and (ii) reduce advantageous inequality by one unit. Given that the model assumes that players (weakly) dislike both types of inequality, it predicts that players ranked 2nd-5th will choose the lower ranked player in their choice set.

A similar argument can be made for players ranked 1st who must choose between players ranked 2nd and 3rd. Choosing the player ranked 2nd will decrease advantageous inequality by one unit and increase disadvantageous inequality by one unit. Since choosing the player ranked 3rd only results in a reduction in advantageous inequality (by 2 units), this model predicts that players ranked 1st will choose the lower ranked player in their choice set as well. The only rank for which this model does not make a prediction is 6th place, because either option would simply increase disadvantageous inequality by two units.

Another inequality aversion, proposed by Bolton and Ockenfels (2000), posits that utility for an individual with payoff x_i in a distribution of $x_1, x_2, \ldots x_N$ can be written as

$$u_i(x_i, x_{j\neq i}) = x_i - \gamma \left| \frac{1}{n} - \left(\frac{x_i}{x_i + \sum_{j\neq i}^{n-1} x_{j\neq i}} \right) \right|.$$

The parameter $\gamma \geq 0$ is a weight that measures a player's concern for inequality, and inequality is measured as the absolute value of the difference between player *i's* payoff if the distribution were equal and player *i's* payoff share of total payoffs for the group. Since decisions in the redistribution game have no influence on the choosing player's share of group earnings, this model predicts that each player is equally likely to choose the lower ranked player in their choice set.

Kuziemko et al. (2014) found that behavior in the redistribution game was largely consistent with predictions from Fehr and Schmidt (1999), with subjects choosing the lower ranked player more than 70% of the time. However, the did observe heterogeneity in behavior across ranks which cannot be explained by either theory. For instance, players facing a rank-equity trade-off (i.e. those ranked 2nd-5th) chose the lower ranked player less often than those who did not face such a trade-off (i.e. those ranked 1st and 6th).[3] Our experiment is designed to examine how earned entitlement might influence these trade-offs and thus, our main hypothesis of interest addresses the decisions made by players ranked 2nd-5th.

3.5 Hypotheses

Given the design and the discussion above, we construct two sets of hypotheses regarding the influence of competition on behavior in the redistribution game. The first set considers the difference in behavior during the redistribution game across random-rank and competitive

[3] While Fehr-and Schmidt (1999) makes no predictions for players in 6th place, Kuziemko et al., (2014) explain their tendency to choose the lower ranked player as a preference for helping subjects with less money than others.

settings for subjects that face a trade-off between equity and rank (i.e. those ranked 2nd-5th). The second set considers the behavior of subjects who do not face a rank-equity trade-off. (i.e. those ranked 1st or 6th).

From the literature on earned entitlement, we find that subjects are often more self-regarding and less concerned with inequality when payoffs are earned. Thus, if subject feel that they have earned their position in the earnings distribution they may be more reluctant to sacrifice their rank for the sake of reducing inequality for the group, which would suggest a decrease in the likelihood of choosing the lower ranked player. On the other hand, subjects may be envious or spiteful toward subjects that outperform them and refrain giving them additional earnings. This suggests that competition may increase the likelihood of players ranked 2nd-5th choosing the player ranked below them. We summarize these predictions below in Hypotheses 1.A and 1.B.

Hypothesis 1.A. (Earned Entitlement) Subjects ranked 2nd-5th are less likely to provide the bonus payment to the lower ranked player in competitive settings than they are when rank is randomly determined.

Hypothesis 1.B. (Competition induces spite/envy) Subjects ranked 2nd-5th are more likely to provide the bonus payment to the lower ranked player in competitive settings than they are when rank is randomly determined.

When considering the behavior in the outer ranks (1st and 6th place), it's important to note that subjects choose between the two players ranked nearest to themselves in the earnings distribution. For those in 1st place, this means selecting either the player in 2nd place or 3rd the player in 3rd. Selecting the lower ranked player (in this case) reduces inequality and preserves one's rank. And, since the player ranked 1st was not outperformed by either player in their choice set, we do not have reason to believe that 1st place behavior will differ significantly across treatments. Similarly, those in 6th place was outperformed by both players in their choice set (players ranked 4th and 5th), and their redistribution decision can have no effect on their final rank in pay. Thus, we do not have reason to believe that 6th place behavior will differ significantly across treatments. We summarize these predictions below, in Hypothesis 2.

Hypothesis 2. The behavior of subjects ranked 1st or 6th will not differ across random-rank and competitive settings.

4. RESULTS

We begin our analysis by examining subjects' tendency to choose the lower ranked player in the redistribution game. To do this, we generate the indicator variable y which is set equal to 1 if the lower ranked player was chosen and calculate subject specific means condition on our random rank condition (RR), the slider-bar task (ET), the mental rotation task (AT), and competitive settings more generally (CT) by pooling observation in ET and AT. In Section 4.1 we test our main hypotheses of interest by examining behavior in RR and CT. Then, in Section 4.2, we take a closer look at our competitive settings by examining behavior in ET and AT individually.

4.1 Random Rank and Competitive Settings

Table D.3 reports sample means of y conditional on our random rank (RR) and competitive (CT) settings. It shows that subjects selected the lower ranked player approximately 72.7% of the time in RR and approximately 68.4% of the time in CT. A cumulative distribution function for individual specific means in RR and CT, respectively, is provided in Figure D.3.

Now we turn our attention to Hypotheses 1 and 2. Because they refer specifically to the redistribution decisions of subjects facing rank-equity trade-offs (i.e. those ranked 2nd-5th) and those who do not (i.e. those ranked 1st and 6th), respectively, we conduct our first tests of these hypotheses using regression analysis. Table D.4 reports regression results with y as the dependent variable, standard errors clustered by subjects, and a dummy variable for CT to capture our treatment effect of interest.

Our first two model specifications in Table D.4 report results from linear regressions using observations from all three stages of each session. Specification 1 controls for decisions in the outer ranks by including fixed effects for first and last place, and our estimated coefficient associated with CT is both negative and statistically significant (p-value = 0.049). Specification 2 builds upon Specification 1 by including interaction terms "First*CT" and "Sixth*CT" to control for differences in y across settings in the outer ranks. Here we find that neither of the estimates associated with our interaction terms are statistically significant (both p-values >0.210). However, we the estimated coefficient associated with CT remains negative, increases in magnitude, and remains statistically significant at the 5% level (p-value = 0.027).

Specifications 3 and 4 estimate our treatment effect of interest using panel regressions with subject specific fixed effects to control order effects and other forms of individual specific heterogeneity. Similar to Specification 1, when controlling for decisions in the outer ranks with dummy variables we estimate a negative a significant effect of CT on choosing the player below oneself in the payoff distribution (p-value = 0.049). Specification 4 includes interaction terms to control for differences in y across settings in the outer ranks, and we also fail to detect a significant difference in our dependent variable across treatment conditions in either of the outer ranks (both p-values > 0.210). We do, however, estimate a negative and significant effect associated with CT (p-value = 0.031). We summarize these results below in Findings 1 and 2.

Finding 1: Subjects ranked 2nd-5th are jointly more likely to choose the player ranked below them (rather than the player ranked above) in the random-rank setting than they are in competitive settings.

Finding 2: We fail to detect a significant difference in redistribution decisions across treatment conditions in either of the outer ranks (1st or 6th).

Next, we estimate rank specific means of y in RR and CT respectively to examine whether the influence of competition is consistent across ranks for players facing a rank-equity trade-off. Figure D.4 plots rank specific means derived from linear regressions. Here we can see that subjects chose the lower ranked player at a higher rate in RR than CT across ranks 2nd-5th, and this difference is statistically significant for ranks 3rd (p-value = 0.007) and 4th (p-value = 0.081).

Figure D.5 plots rank specific mean from fixed effect panel regressions. Again, we find that means of y in RR associated ranks 2nd-5th respectively, are greater than those in CT. The only rank specific difference in means that reaches statistical significance is that associated with 3rd place (p-value = 0.006), although joint difference between 4th and 5th place across RR and CT is significant at the 10% level (p-value =0.083). We summarize these results below in Finding 3.

Finding 3: Subjects ranked 3rd are significantly less likely to choose the lower ranked player ranked in CT than in RR.

Findings 1 and 3 contradict Hypothesis 1.B and are consistent with Hypothesis 1.A. The provide some support for the claim that subjects are more concerned with preserving their rank in pay when their position along the payoff distribution is earned. Finding 2 is consistent with Hypothesis 2 and suggests that earned entitlement does not have a significant influence on the trade-offs facing players rank first or last in the redistribution game. In the following subsection, we examine behavior in ET and AT individually to see whether our findings across tasks.

4.2 Ability and Effort Tasks

Table D.5 in reports sample means of y conditional on AT and ET. Here we find that subjects chose the lower ranked player in their choice set 68% of the time in AT. Meanwhile, in ET, subjects chose the lower ranked player 68.7% of the time.

To compare the decisions in RR with those in AT and ET respectively, we report regression results in Table D.6. Each model specification includes y as the dependent variable with fixed effect for decisions made in the outer ranks, and clustered standard errors (by subject). This allows us to capture our treatment effects of interest with dummy variables for AT and ET. capture our treatment effects of interest.

Our first two model specifications report results from linear regressions. Specification 1 finds a negative effect for both competitive settings. While the estimated coefficient associated with AT is significant at the 5% level (p-value = 0.047), the estimated coefficient associated with ET is negative but marginally insignificant (p-value = 0.103). Specification 2 builds upon Specification 1 by including interaction terms between our outer rank dummy variables with ET and AT, respectively. Compared to RR, we find subjects ranked 2^{nd}-5^{th} were 6.9% less likely to choose the player below in AT and 4.2% less likely to do so in ET. However, while the estimated coefficient with AT is highly significant (p-value = 0.007), the estimate associated with ET does is not significant (p-value = 0.130).

To control order effects and other forms of individual specific heterogeneity, Specifications 3 and 4 estimate our treatment effects of interest using panel regressions with subject specific fixed effects. Specification 3 detects a significant decrease in the likelihood that subjects ranked 2nd-5th choose the player below in AT relative to RR (p-value = 0.049), and a negative but insignificant effect associated with ET (p-value = 0.105). In Specification 4, we include interaction terms between outer rank dummy variables with AT and ET and find similar results. Our estimated coefficient associated with AT is negative and significant (p-value = 0.015), while the estimated coefficient associated with ET is negative but insignificant (p-value = 0.101). We summarize these results below in Finding 4.

Finding 4: Subjects Ranked 2nd-5th are more likely to choose the player ranked below them in the random-rank setting than they are in either competitive setting, though this difference is most significant in AT.

Next, we estimate rank specific means of y in AT and ET respectively to examine whether the influence of competition is consistent across ranks in each task when players facing a rank-equity trade-off. Figure D.6 plots rank specific means derived from linear regressions. Here we can see that the means of y in AT associated ranks 2nd, 4th and 5th respectively, are less than those than those in ET but not significantly so. Compared to RR, the means for third place are significantly smaller in both AT (p-value = 0.005) and ET (p-value = 0.018), and the same is true for our fourth place mean in AT (p-value = 0.055).

Figure D.7 plots rank specific means from fixed effect panel regressions. Here we find that means of y in both AT and ET associated with ranks 2nd-5th are less than those in RR. Similar to our previous results, we detect a significant difference between our estimated mean for 3rd and 4th place in AT (p- value = 0.000) and for third place in ET (p-value = 0.021). We summarize these results below in Finding 5.

Finding 5: Subjects ranked 3rd are significantly less likely to choose the lower ranked player ranked in AT and ET than in RR.

5. ADDITIONAL EXPLORATIONS

We continue our analysis by incorporating individual level characteristics in an attempt to explain some of the variation in outcomes across subjects. First, we consider the relationship between behavior in the redistribution game and mean performance in our competitive tasks. Then we use responses to our post experiment questionnaire to examine individual differences in preferences regarding the US Federal minimum wage and personality as measured by the Big Five Personality index.

5.1 Mean Performance

Table D.7 reports mean scores in our effort and ability tasks along with estimated spearman correlation coefficients between subject specific means for y and each score, respectively. Here we can see that average performance in the slider-bar task is positively correlated with choosing the lower ranked player and that this relationship is significant at the 5% level (p-value = 0.0295). Average performance in the mental rotation task appears to have a negative relationship with choosing the lower ranked player, though we fail to reject the null hypothesis the two variables are statistically independent (p-value = 0.4689).

Table D.8 reports results from linear regressions similar to the Specification 4 in Table D.6, but with additional controls for mean scores in AT and/or ET. Here we find similar treatment effect to those reported in Table D.6, which suggests that they are robust to controls for mean performance. Specification 1 estimates a negative but insignificant relationship between mean performance in the mental rotation task and choosing the lower ranked player (p-value = 0.495), while Specification 2 estimates a positive and significant relationship between performance in the slider-bar task and choosing the lower ranked player (p-value = 0.046).

Specification 3 controls for mean performance for both tasks simultaneously and finds similar results, estimating a positive and significant coefficient associated with mean performance in ET (p-value = 0.044) and a negative but insignificant coefficient associated with mean performance in AT (p-value = 0.367). Our last model specification in Table D.8 augments Specification 2 by controlling for the influence of mean slider-bar task performance on y in ET. Specification 4 shows that the relationship between mean performance in slider-bar task and choosing the lower ranked is still positive but is no longer statistically significant (p-value = 0.116) independent of its influence in ET specifically. We summarize these results below, in Finding 6.

Finding 6: Mean performance in the slider bar task is associated with a higher likelihood of choosing the lower ranked player in the redistribution game. However, this relationship is most significant for players in 1st place, and is statistically insignificant for ranks 2nd-5th.

5.2 Minimum Wage

Next, we consider the relationship between behavior in the redistribution game and subjects' opinions regarding the US Federal Minimum Wage. Policy proposals to increase the federal minimum wage have received considerable attention in recent years as a means reduce income inequality by redistributing wealth towards those at or near the bottom of the current income distribution. We predict that individuals with more conservative opinions regarding the US Federal Minimum wage will also be less likely to choose the lower ranked player in the redistribution game.

At the end of each session, subjects were asked what they think the US Federal Minimum Wage should be. A summary of the potential responses and the distribution of their relative frequency in our sample can be found in Table D.9. There you can see that responses associated with affirmative opinions are arranged ordinally with the variable MW.[4] Figure D.8 plots individual specific means of y conditional on MW. Here, we can see an upward trend in the likelihood of choosing the lower ranked player as subjects' preferred minimum wage increases. This intuition is confirmed by a spearman's rank correlation test, which detects a positive relationship between the two variables that significant at the 1% level (p-value = 0.005).

To test whether the effect associated with our minimum wage elicitation is particularly salient to subjects facing rank/equity trade-offs, we use regression analysis. Table D.10 reports our results derived from linear regressions with clustered standard errors. Each model specification includes a fixed effect for CT, fixed effects for the outer ranks, and interaction terms First*CT and Sixth*CT. This allows us to estimate the difference in the probability of choosing the player

[4] Approximately 6.3% of subjects in our sample did not know what they thought the minimum wage should be. For these observations, MW is set equal to a missing value.

below when ranked 2^{nd}-5^{th} between subjects with relatively conservative/liberal opinions regarding the Federal Minimum Wage.

Specification 1 in Table D.10 uses a dummy variable *MW[0|1|2]* set equal to 1 for subjects with relatively conservative opinions regarding the minimum wage.[5] Here we find that the estimated coefficient associated with *MW[0|1|2]* is negative and highly significant (p-value = 0.004). Specification 2 controls for variation across our minimum wage indicator in the outer ranks with interaction terms *MW[0|1|2]*First* and *MW[0|1|2]*Sixth*, and captures our estimated effect of interest with another interaction term between *MW[0|1|2]* and an indicator variable for ranks 2^{nd}-5^{th}. Here we find that subjects with conservative opinions regarding the minimum wage are approximately 11.5% less likely than others to choose the player below, and this difference is also statistically significant at the 1% level (p-value = 0.008).

The remaining model specifications in Table D.10 expand upon Specification 2 by interacting our minimum wage indicators specific to ranks First, Middle, and Sixth with dummy variables for RR and CT. This allows us to compare the likelihood of choosing the lower ranked player across *MW[0|1|2]* in random rank and competitive settings, respectively. Specification 3 shows that subjects with relative conservative opinions regarding the minimum wage are approximately 11.2% less likely to choose the lower ranked player than others in RT (p-value = 0.019), 11.8% less likely to do so in CT (p-value = 0.020), and that both of these differences are statistically significant.

Specification 4 shows that the effects found in Specification 3 remain negative and significant when we control for political affiliation with the *Republican* and *Libertarian* parties (p-values < 0.030), and Specifications 5 and 6 show that the same is true when we control for difference in mean performance in our effort and ability tasks (p-values < 0.027). Thus, it appears that subjects with relatively conservative opinions regarding the minimum wage are significantly less likely to choose the lower ranked player in the redistribution game than others when facing rank-equity trade-offs. We summarize these results below in Thus, it appears that the subjects with relatively conservative opinions regarding the minimum wage are significantly less likely to choose the

[5] Specifically, we set our dummy variable *MW[0|1|2]* equal to 1 if *MW* is equal to 0, 1 or 2. Otherwise, variable *MW[0|1|2]* is set equal to 0.

lower ranked player in the redistribution game than others when facing rank-equity trade-offs. These differences are consistent in both random rank and competitive settings and are robust to controls for political party affiliation and mean performance in either competitive task.

5.3 Personality Traits

The relationship between personality and behavior is a seminal topic in social psychology (Murray, 1938). Studies examining the relationship between personality traits and economic preferences find conscientiousness to be a strong predict of a wide variety of outcomes (for a review, see Almlund, Duckworth, Heckman & Kaitz 2011). Because this personality trait is positively associated with status striving, competitiveness (Bartling et al., 2009), procedural fairness (Colquitt & Scott, 2006) and earned entitlement (Colquitt & Scott et al., 2006), we predict that this personality trait will be negatively associated with choosing the lower ranked player.

At the end of each session, subjects responded 25 items selected from the BFI 44 (Benet-Martínez & John, 1998). A summary of scores for each personality trait can be found in Table D.11, along with estimated Spearman's correlation coefficients between individual specific means of y with each measure, respectively. Of the five personality traits we elicit, only conscientiousness has a statistically significant relationship with our dependent variable (p-value = 0.0916). As predicted, the estimated coefficient is negative and an illustration of this relationship can be seen in Figure D.9.

To test whether the effect associated with conscientiousness is particularly salient to subjects facing rank/equity trade-offs, we use regression analysis. Table D.12 reports our results derived from linear regressions with clustered standard errors. Each model specification includes a fixed effect for CT, fixed effects for the outer ranks, and interaction terms First*CT and Sixth*CT. This allows us to estimate a linear effect of *Conscientiousness* on the probability of choosing the player below when ranked 2^{nd}-5^{th}.

Specification 1 in Table D.12 uses subject specific scores for *Conscientiousness* as our dependent variable of interest, and finds that the estimated coefficient associated with it is negative and significant at the 5% level (p-value = 0.020). Specification 2 controls for variation across conscientiousness scores in the outer ranks with interaction terms *Conscientiousness*First* and *Conscientiousness *Sixth*, and captures our estimated effect of interest with another interaction term between *Conscientiousness* and an indicator variable for ranks 2nd-5th. Here we find that the positive and significant effect associated with *Conscientiousness* is both negative and significant for subjects facing rank-equity trade-offs (p-value = 0.015).

The remaining model specifications in Table D.12 expand upon Specification 2 by interacting our *Conscientiousness* scores specific to ranks First, Middle, and Sixth with dummy variables for RR and CT. This allows us to estimates the effect of *Conscientiousness* on the likelihood of choosing the lower ranked player in random rank and competitive settings, respectively. Specification 3 estimates a positive and significant effect of *Conscientiousness* one the likelihood of choosing the lower ranked player when placed in the middle ranks in both RT (p-value = 0.054) and CT (p-value = 0.034). Meanwhile, Specifications 4 and 5 show that the same is true when we control for difference in mean performance in our effort and ability tasks (p-values < 0.039). These results suggest that *Conscientiousness* has a negative and significant relationship with choosing the lower ranked player when it reduces one's rank in the final earnings distribution.

6. CONCLUSION

This paper examines whether earned entitlement has an influence on preferences over equity and ordinal position in the earnings distribution by examining behavior in the redistribution game (Kuziemko et al., (2014)) under both random rank competitive conditions to investigate. Our results show that subjects facing a trade-off between equity and rank were less likely to choose the lower ranked player in a competitive setting, and this effect is largely consistent across environments where earnings are determined by real-effort or ability. These findings support the claim that subjects would become more concerned with preserving their ordinal rank in the pay than reducing inequality when payoffs were earned, and they provide further evidence for experimental settings that distributions determined by effort or innate ability engender a sense of earned entitlement (Hoffman, 1985; Oxoby & Spraggon, 2008; Iida, 2015).

When we examine the rank specific effects of competition on behavior in the redistribution game, we find that the negative effect on choosing the lower ranked player is particularly strong for players placed 3rd in the initial earnings distribution. In this case, a $2 increase in pay for the lower ranked (i.e. the player ranked 4th) would cause would cause the choosing player to fall below the median of the earnings distribution. Thus, our findings suggest that this reduction in ordinal position may be particularly salient when the payoff distribution is determined by effort and ability rather than chance.

Additional results of interest are derived using responses from our post experiment questionnaire subjects' personality traits and opinions regarding the Federal Minimum Wage. In both random rank and competitive settings, we find that subjects with conservative opinions regarding the minimum wage are significantly less likely to choose the lower ranked player when doing so could reduce their rank in pay. These findings suggest that individuals that oppose a significant increase in the federal minimum wage are relatively more concerned with preserving their rank than reducing inequality in the earnings distribution, and they provide some support for claims that opposition to an increase in the minimum wage by individuals near the bottom of the income distribution may be driven by concerns over a reduction in ordinal position.

Regarding personality traits, we detect a significant negative relationship between choosing the lower ranked player in the redistribution game and conscientiousness as measured by the BFI44 (Benet-Martinez & John, 1998). This relationship is statistically significant for players facing rank-equity trade-offs in both random rank and competitive settings, which suggests that greater conscientiousness is associated with more concern with maintaining one's rank in pay and less concern with reducing inequality in the earnings distribution. These results contribute to a growing literature on the role personality plays in economic decision making, finding conscientiousness to be positively correlated with concerns for status (Bartling et al., 2009), procedural fairness and earned entitlement (Colquitt & Scott et al., 2006).

Appendix D: Tables and Figures

Table D.1: Initial payoff distribution and choice set

Rank	Initial Payoff	Choice set: Give $2 to…
1st	$6	2nd or 3rd place player
2nd	$5	1st or 3rd place player
3rd	$4	2nd or 4th place player
4th	$3	3rd or 5th place player
5th	$2	4th or 6th place player
6th	$1	4th or 5th place player

Table D.2: Treatment Table

Stage	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5	Treatment 6
1	Random	Random	Effort	Effort	Ability	Ability
2	Effort	Ability	Random	Ability	Random	Effort
3	Ability	Effort	Ability	Random	Effort	Random

Table D.3: Mean of y across random and competitive settings

Treatment	Mean(y)	Standard Dev.	Min	Max
Random Rank	0.727	0.314	0	1
Competition	0.684	0.328	0	1

Notes: This table reports the mean of the proportion of bonus payments given to the lower ranked player for each subject in random and competitive settings.

Table D.4: Effect of CT

	[1]	[2]	[3]	[4]
Competitive	-0.043**	-0.056**	-0.043**	-0.053**
	(0.022)	(0.025)	(0.022)	(0.024)
First	0.098	0.06	0.095	0.093
	(0.028)	(0.038)	(0.026)	(0.038)
Sixth	0.084	0.071	0.087	0.051
	(0.023)	(0.03)	(0.019)	(0.028)
First*Comp.		0.057		0.003
		(0.043)		(0.041)
Sixth*Comp.		0.019		0.057
		(0.044)		(0.037)
Constant	0.696	0.705	0.696	0.703
	(0.024)	(0.024)	(0.016)	(0.017)
OLS	✓	✓		
Fixed Effects			✓	✓

Notes: Std. Errors are in parentheses, and clustered by subject. The dependent variable in each regression is an indicator equal to 1 if the lower ranked player was chosen. *p<.10, **p<.05, ***p<.01.

Table D.5: Means of y Across Competitive Settings

Task	Mean(y)	Standard Dev.	Min	Max
AT	.680	.349	0	1
ET	.687	.362	0	1

Notes: This table reports the mean of the proportion of bonus payments given to the lower ranked player for each subject in random and competitive settings.

Table D.6: Effects of AT and ET

	[1]	[2]	[3]	[4]
AT	-0.046^{**}	-0.069^{***}	-0.046^{**}	-0.062^{**}
	(0.023)	(0.027)	(0.023)	(0.025)
ET	-0.039	-0.042	-0.039	-0.043
	(0.024)	(0.028)	(0.024)	(0.027)
First	0.098^{***}	0.06	0.095^{***}	0.093^{**}
	(0.028)	(0.038)	(0.026)	(0.038)
Sixth	0.084^{***}	0.071^{**}	0.087^{***}	0.051^{*}
	(0.023)	(0.03)	(0.019)	(0.028)
First*AT		0.065		0.023
		(0.05)		(0.05)
Sixth*AT		0.069		0.07^{*}
		(0.044)		(0.042)
First*ET		0.05		-0.019
		(0.053)		(0.044)
Sixth*ET		-0.031		0.042
		(0.059)		(0.044)
Constant	0.696^{***}	0.705^{***}	0.696^{***}	0.703^{***}
	(0.024)	(0.024)	(0.016)	(0.017)
OLS	✓	✓		
Fixed Effects			✓	✓

Notes: Results are derived from linear regressions. Std. Errors are in parentheses and clustered by subject. The dependent variable in each regression is an indicator equal to 1 if the lower ranked player was chosen. *p<.10, **p<.05, ***p<.01.

Table D.7: Mean Performance

Variable	Obs.	Mean	Std. Dev.	Min	Max	Spearman's ρ
Mean(Ability Score)	222	4.91	1.40	1.57	8.71	-0.037
Mean(Effort Score)	222	8.54	3.18	0	18.86	0.146^{**}

Notes: Reports the average score from each competitive task, respectively. In the column titled "Spearman's ρ", we report estimates testing the null hypothesis that an individual subject's mean score is independent of their tendency to choose the lower ranked player. (*p<.1, **p<.05, ***p<.01).

Table D.8: Performance Regressions

	[1]	[2]	[3]	[4]	[5]
AT	-0.069**	-0.068**	-0.068**	-0.068**	-0.068**
	(0.027)	(0.026)	(0.027)	(0.027)	(0.026)
ET	-0.042	-0.045	-0.044	-0.045	-0.091*
	(0.028)	(0.028)	(0.028)	(0.028)	(0.052)
First	0.061	0.06	0.061	0.001	0.06
	(0.038)	(0.038)	(0.038)	(0.085)	(0.038)
Sixth	0.073**	0.067**	0.069**	0.073**	0.068**
	(0.03)	(0.029)	(0.029)	(0.069)	(0.029)
First*AT	0.076	0.055	0.07	0.05	0.056
	(0.052)	(0.049)	(0.051)	(0.049)	(0.05)
Sixth*AT	0.058	0.076*	0.062	0.075*	0.076*
	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)
First*ET	0.051	0.019	0.019	0.002	0.009
	(0.053)	(0.05)	(0.051)	(0.05)	(0.052)
Sixth*ET	-0.035	0.015	0.011	0.009	0.028
	(0.059)	(0.056)	(0.055)	(0.056)	(0.057)
Mean(Ability)	-0.008		-0.012		
	(0.013)		(0.014)		
Mean(Effort)		0.012*	0.012*	0.011	0.01
		(0.007)	(0.007)	(0.007)	(0.007)
Mean(Effort)*1st				0.007	
				(0.008)	
Mean(Effort)*6th				-0.001	
				(0.007)	
Mean(Effort)*ET					0.005
					(0.005)
Constant	0.744	0.605	0.655	0.613	0.616
	(0.07)	(0.061)	(0.077)	(0.066)	(0.061)

Note: Results are derived from linear regressions. Std. Errors are in parentheses and clustered by subject. The dependent variable in each regression is an indicator equal to 1 if the lower ranked player was chosen. *p<.10, **p<.05, ***p<.01.

Table D.9: Opinions Regarding the US Federal Minimum Wage

MW	Response	% of sample
0	"decrease"	2.7%
1	"stay the same"	27.5%
2	"increase to somewhere between $7.26-9.66 per-hour"	26.1%
3	"increase to somewhere between $9.67-12.08 per-hour"	25.2%
4	"increase to somewhere between $12.09-14.49 per-hour"	7.2%
5	"increase to$14.50 or more"	5%
.	"I don't know"	6.3%

Notes: During the post experiment questionnaire, subjects were asked their opinion regarding changes in the US Federal Minimum wage. The 7 available responses are listed above, along with the percentage of subjects in our sample that selected each response.

Table D.10: BFI Scores

Variable	Mean	Std. Dev.	Spearman's ρ (w/ PR)
Extraversion	12.4	3.71	-0.110
Agreeableness	14.2	2.94	0.044
Conscientiousness	13.1	3.18	-0.114*
Openness	13.8	2.89	-0.050
Neuroticism	10.2	3.43	0.006

Notes: During the post experiment questionnaire, subjects responded to 25 of the 43 items in the BFI 44 (John and Benet-Martinez, 1998) which measures the "Big Five" personality traits introduced by Goldberg (1993).

Table D.11: Minimum Wage Regressions

	[1]	[2]	[3]	[4]
MW[0|1|2]	-0.108***	-0.104***	-0.102**	-0.115***
	(0.037)	(0.038)	(0.041)	(0.043)
Republican		-0.011		
		(0.044)		
Libertarian		-0.078		
		(0.079)		
MW{0|1|2]*Comp.			-0.009	
			(0.042)	
MW[0|1|2]*1st				0.043
				(0.055)
MW[0|1|2]*6th				0.001
				(0.046)
Constant	0.772***	0.778***	0.768***	0.776***
	(0.031)	(0.033)	(0.032)	(0.033)

Notes: Estimates are derived from the linear regression $y_i = \sum_{k=1}^{K} \beta^k X^k + \delta^0 CT_i + \delta^1 First_i + \delta^2 Sixth_i + \delta^3 First_i * CT_i + \delta^4 Sixth_i * CT_i + \epsilon_i$ where X^k is our vector of covariates, CT_i is an indicator variable equal to 1 if player *i* is taking part in either competitive task, $First_i$ is an indicator variable equal to 1 if player *i* is ranked first, $Sixth_i$ is an indicator variable equal to 1 if player *i* is ranked sixth, and standard errors are clustered by subject.

Table D.12: Conscientiousness Regressions

	[1]	[2]	[3]	[4]
Conscientiousness	-0.013**	-0.016**	-0.012*	-0.015**
	(0.005)	(0.007)	(0.007)	(0.006)
Consc*1st		0.018**	0.017*	0.018**
		(0.009)	(0.009)	(0.009)
Consc*6th		0.002	0.002	0.002
		(0.007)	(0.007)	(0.007)
Consc*Comp.			-0.004	
			(0.008)	
MW[0|1|2]			-0.101***	-0.101***
			(0.037)	(0.037)
Constant	0.933***	0.993***	0.987***	1.032***
	(0.102)	(0.122)	(0.124)	(0.118)

Notes: Estimates are derived from the linear regression $y_i = \sum_{k=1}^{K} \beta^k X^k + \delta^0 CT_i + \delta^1 First_i + \delta^2 Sixth_i + \delta^3 First_i * CT_i + \delta^4 Sixth_i * CT_i + \epsilon_i$ where X^k is our vector of covariates, CT_i is an indicator variable equal to 1 if player *i* is taking part in either competitive task, $First_i$ is an indicator variable equal to 1 if player *i* is ranked first, $Sixth_i$ is an indicator variable equal to 1 if player *i* is ranked sixth, and standard errors are clustered by subject.

(a) Initial position.   (b) Positioned at 50.

Figure D.1: Slider-Bar Task (Example)

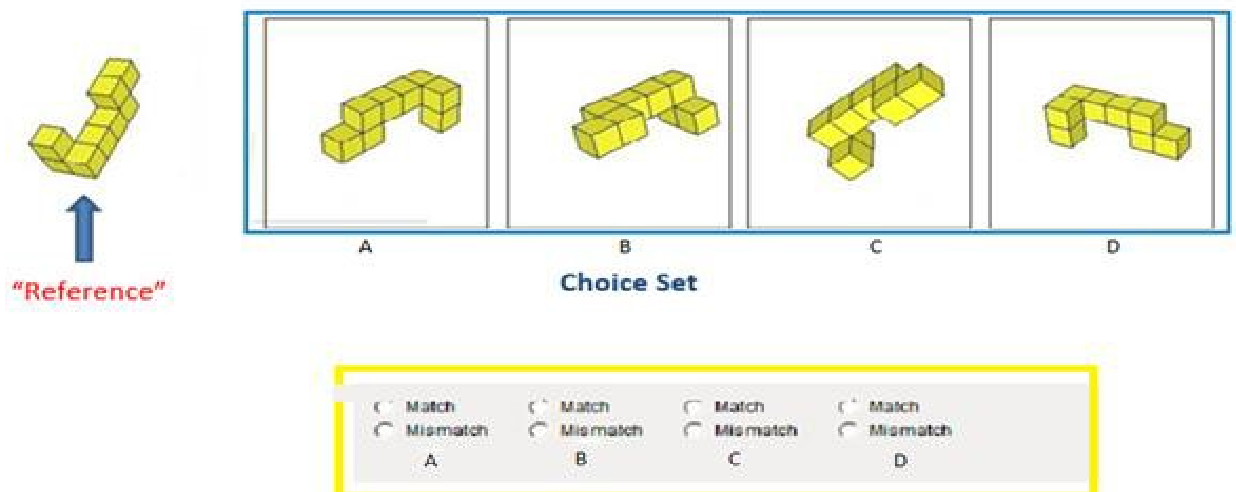
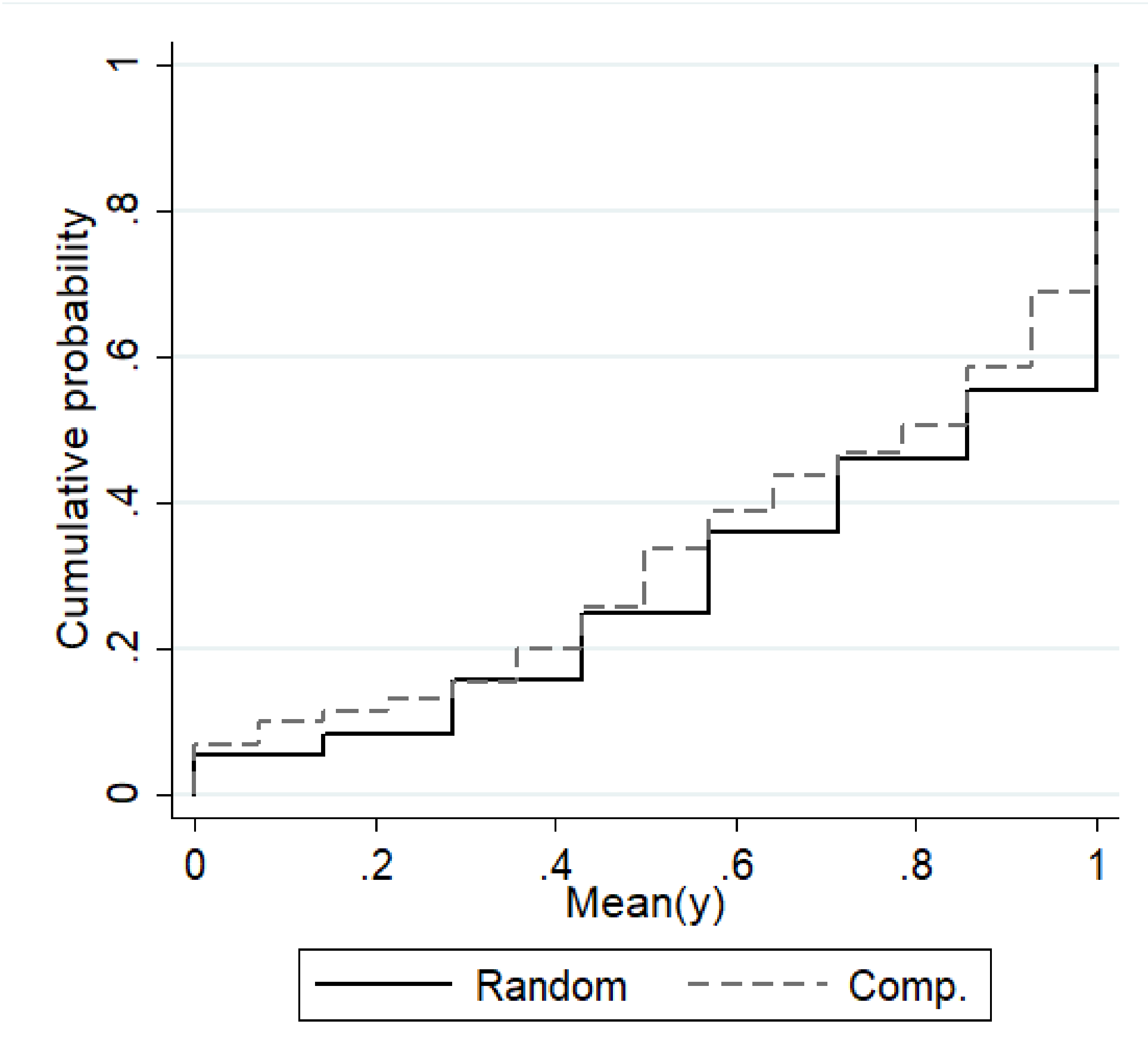
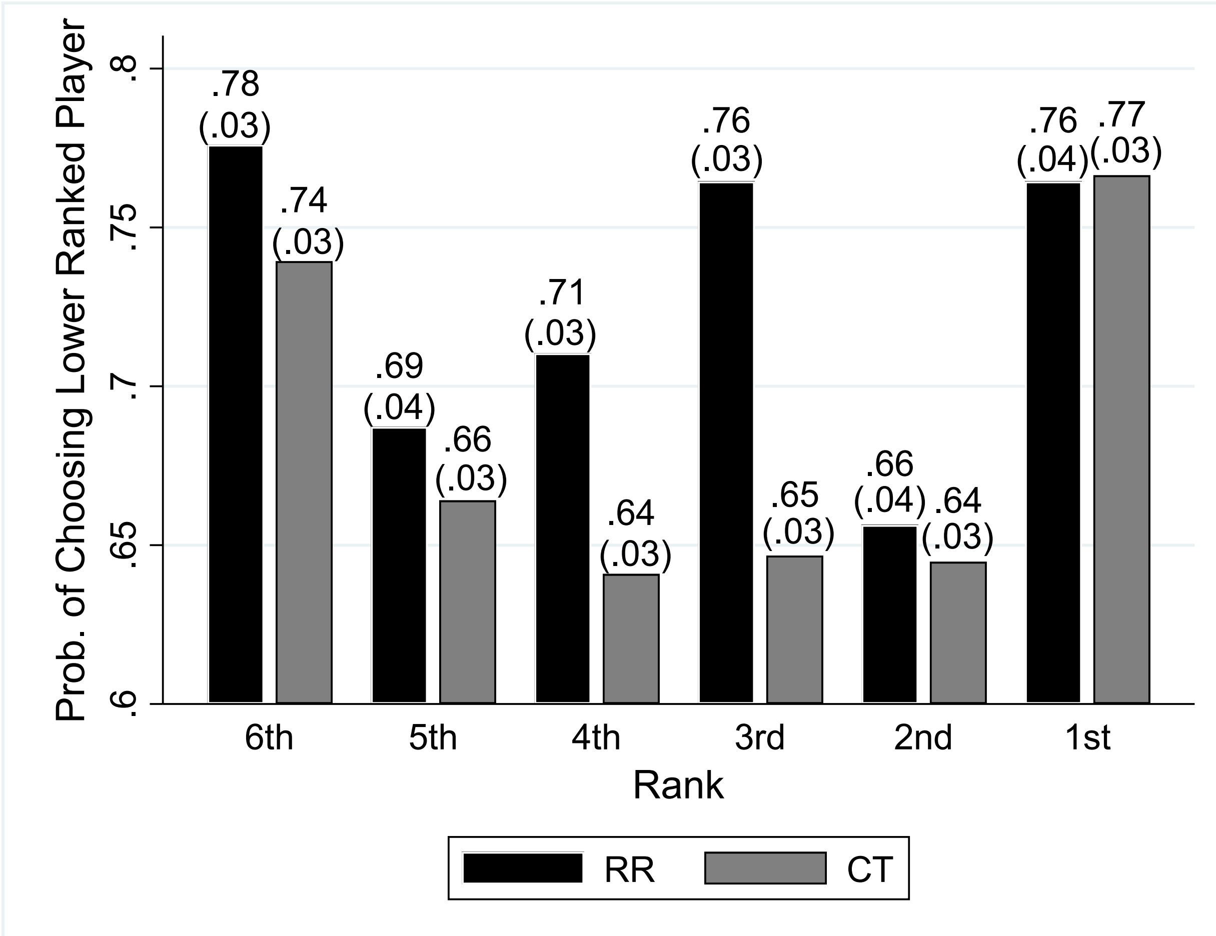


Figure D.2: Mental Rotation Task (Example)



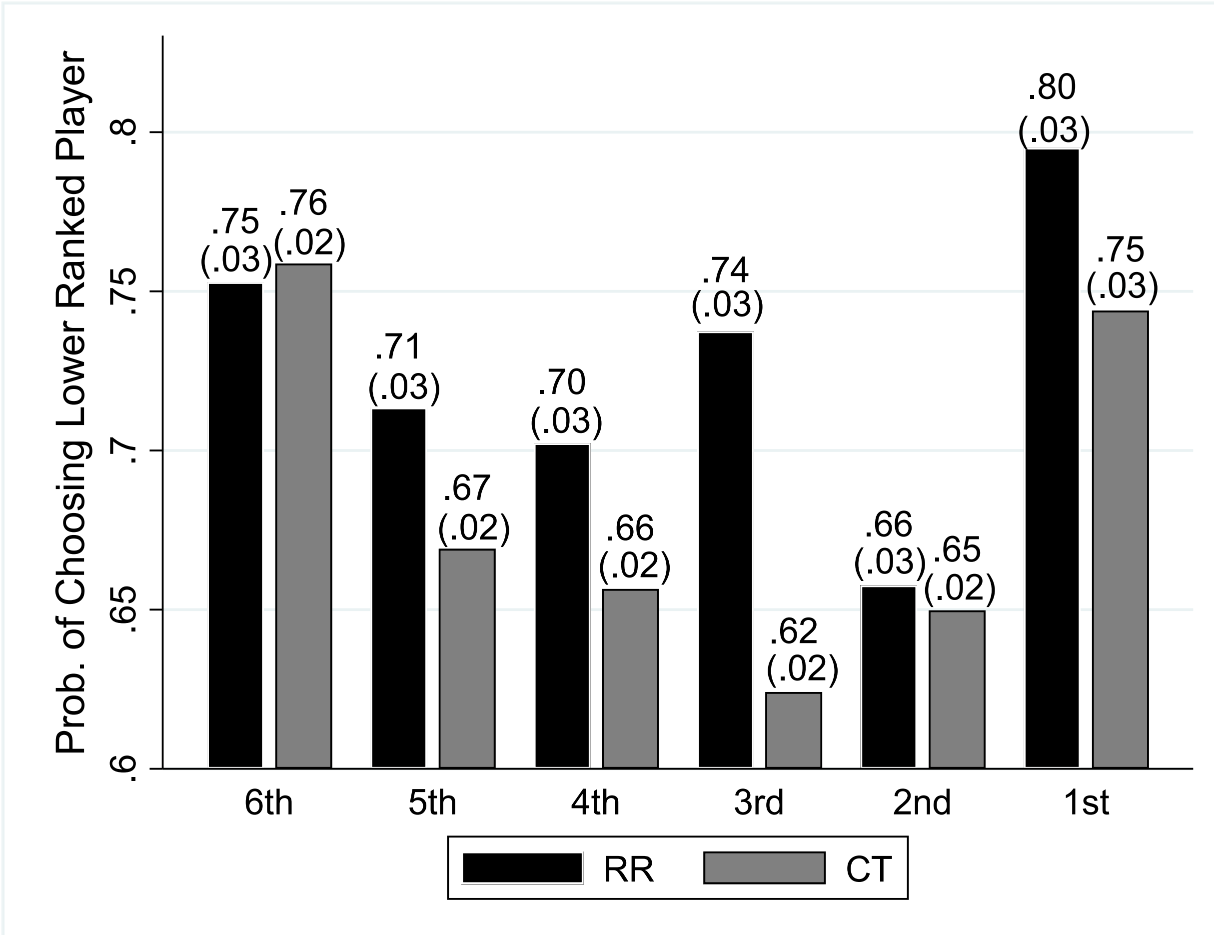
Notes: The figure plots the distribution of individual specific means reported Table 2.

Figure D.3: Distribution of Mean(y)



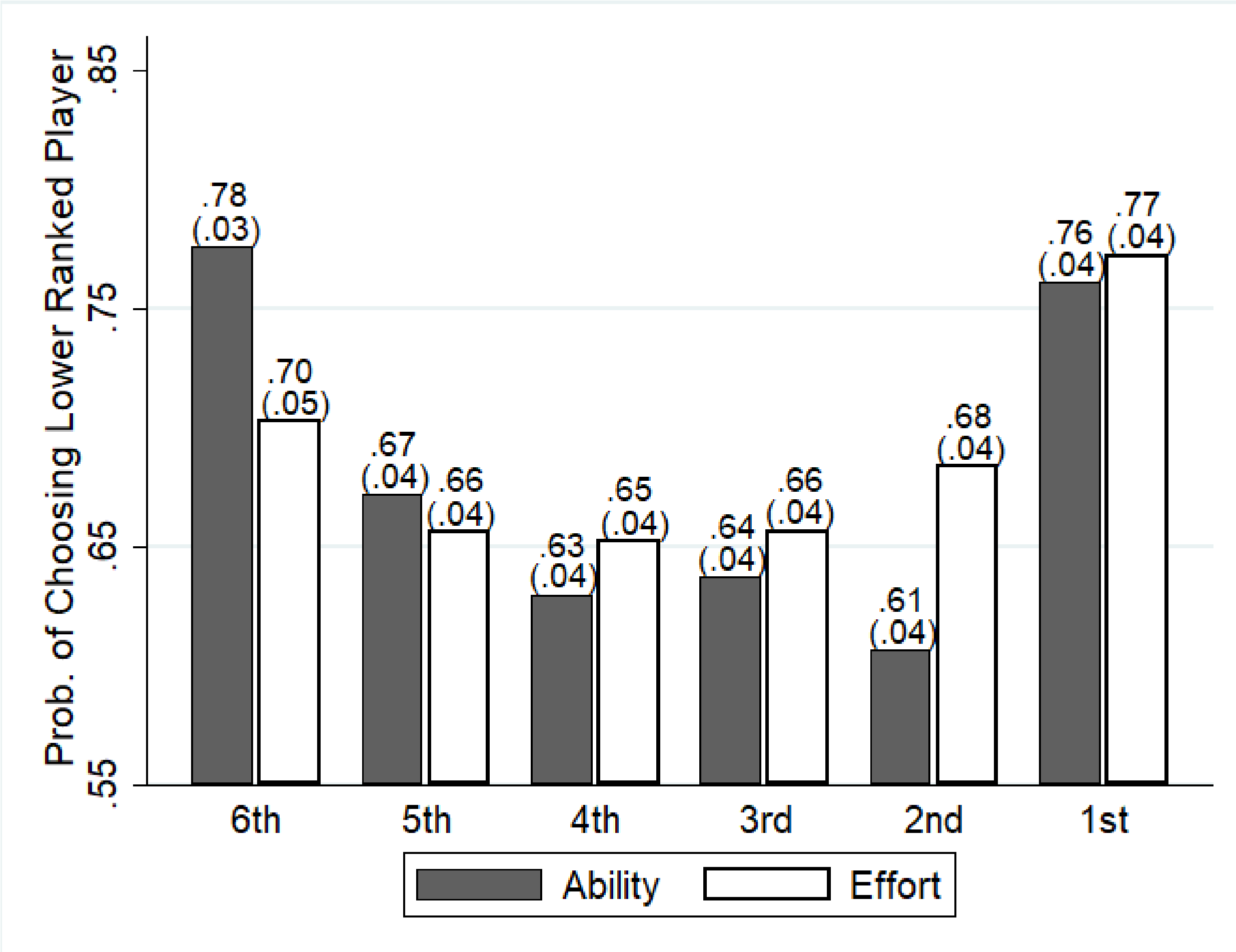
Notes: Means are derived from the linear regression $y_i = \sum_{k=1}^{6} \beta^k rank_i^k + \sum_{k=1}^{6} \beta^k rank_i^k * CT_i + \epsilon_i$, where $rank_i^k$ is an indicator for player i having rank k, CT_i is an indicator variable equal to 1 if player i is taking part in either competitive task, standard errors are clustered by subject, and no other controls variables. No constant term is included in the regression. Only observations from the first stage of play in each session are included. The y-axis values are the OLS coefficients, and standard errors are reported in parenthesis.

Figure D.4: Probability of Choosing the Lower Ranked Player in Their Choice Set (OLS)



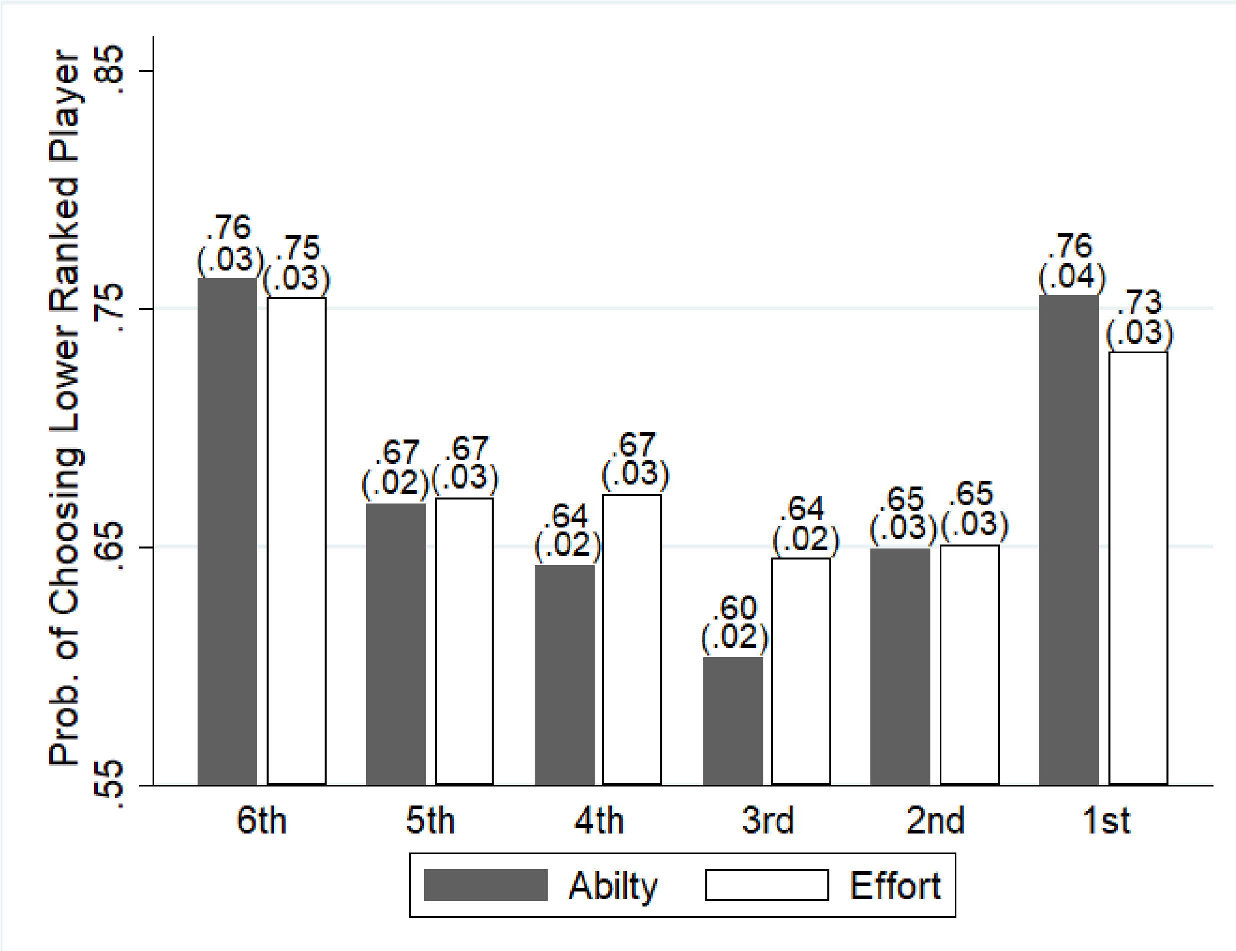
Notes: Means are derived from the fixed effect panel regression $\ddot{y}_{it} = \sum_{k=2}^{6} \beta^k \ddot{rank}_{it}^k + \sum_{k=1}^{6} \beta^k \ddot{rank}_{it}^k * CT_{it} + \epsilon_{it}$ where $\ddot{rank}_{it}^k$ is an indicator for player i having rank k at time t, CT_{it} is an indicator variable equal to 1 if player i is taking part in either competitive task at time t, standard errors are clustered by subject, and no other controls variables are included. The y-axis values are the fixed effects coefficients plus the constant term, and standard errors are reported in parenthesis.

Figure D.5: Probability of Choosing the Lower Ranked Player in Their Choice Set (FE)



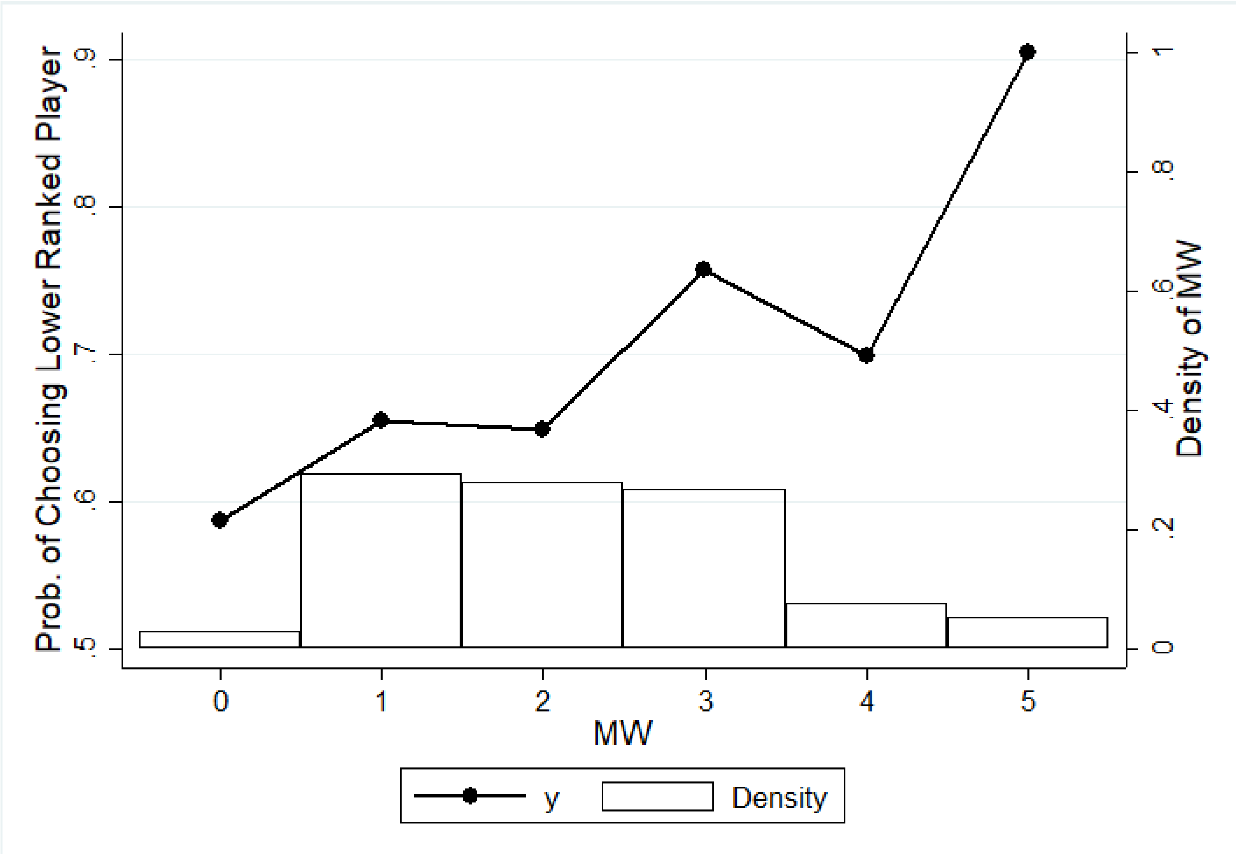
Notes: Means are derived from the linear regression $y_i = \sum_{k=1}^{6} \beta^k rank_i^k + \sum_{k=1}^{6} \beta^k rank_i^k * AT_i + \sum_{k=1}^{6} \beta^k rank_i^k * ET_i$ where $rank_i^k$ is an indicator for player i having rank k, AT_i is an indicator variable equal to 1 if player i is taking part in the ability task, ET_i is an indicator variable equal to 1 if player i is taking part in the effort task, standard errors are clustered by subject, and no other controls variables. No constant term is included in the regression. Only observations from the first stage of play in each session are included. The y-axis values are the OLS coefficients, and standard errors are reported in parenthesis.

Figure D.6: Probability of Choosing the Lower Ranked Player in AT and ET (OLS)



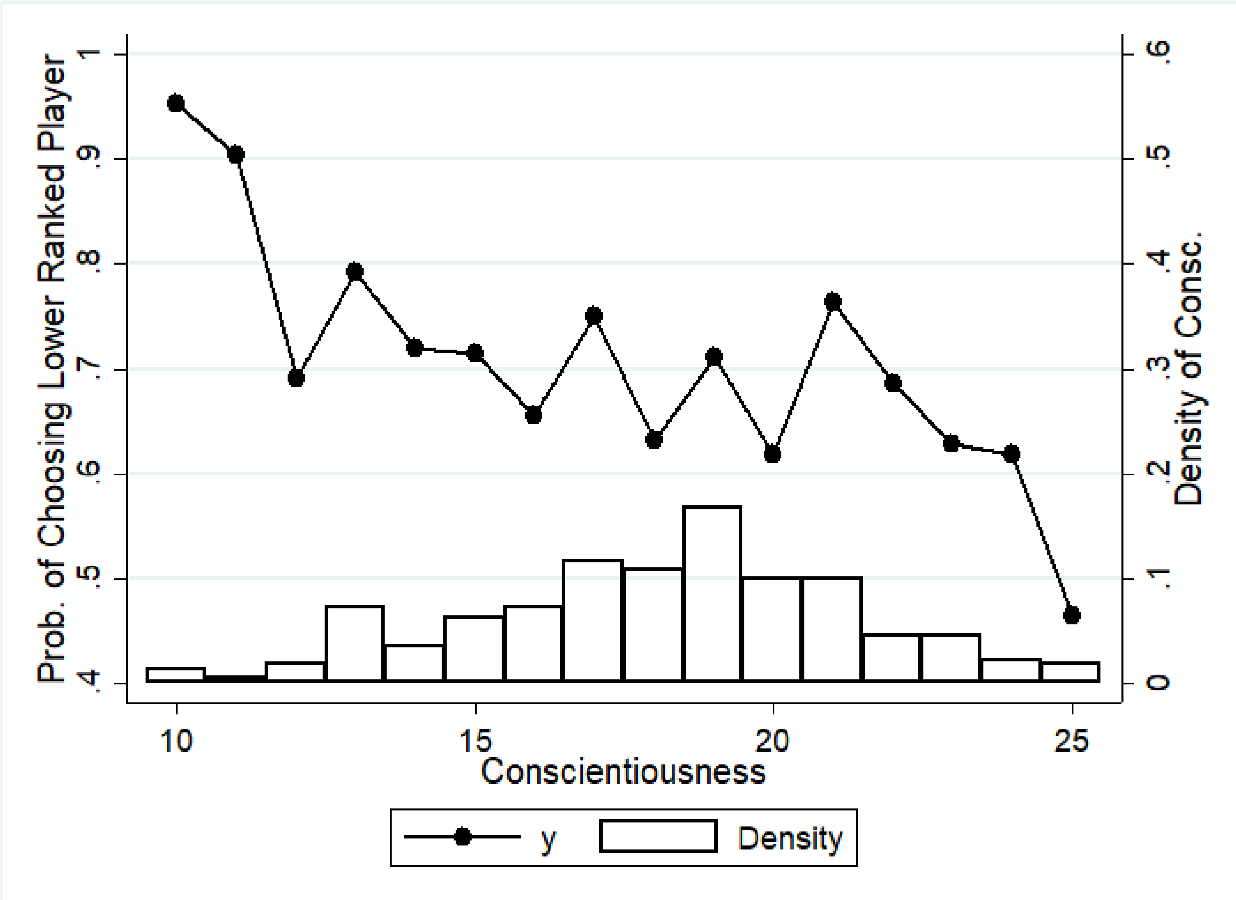
Notes: Notes: Means are derived from the fixed effect panel regression $\ddot{y}_{it} = \sum_{k=2}^{6} \beta^k r\ddot{a}nk_{it}^k + \sum_{k=1}^{6} \beta^k r\ddot{a}nk_{it}^k * AT_{it} + \sum_{k=1}^{6} \beta^k r\ddot{a}nk_{it}^k * ET_{it} + \epsilon_{it}$ where $r\ddot{a}nk_{it}^k$ is an indicator for player *i* having rank *k* at time *t*, AT_{it} is an indicator variable equal to 1 if player *i* is taking part in the ability task at time *t*, ET_{it} is an indicator variable equal to 1 if player *i* is taking part in the effort task at time *t,* standard errors are clustered by subject, and no other controls variables are included. The y-axis values are the fixed effects coefficients plus the constant term, and standard errors are reported in parenthesis.

Figure D.7: Probability of Choosing the Lower Ranked Player during AT and ET (FE)



Notes: The connected line plots the proportion of bonus payments assigned to the lower ranked player conditional on *MW*. Bars plot the density histogram of *MW* for the sample.

Figure D.8: Mean of y conditional on MW



Notes: The connected line plots the proportion of bonus payments assigned to the lower ranked player conditional on *Conscientiousness*. Bars plot the density histogram of *Conscientiousness* for the sample.

Figure D.9: Mean of y conditional on Conscientiousness

CHAPTER III:

THE EFFECT OF INEQUALITY ON RELATION SPECIFIC INVESTMENT AND HOLD-UP: A CROSS-CULTURAL EXAMINATION

ABSTRACT

The hold-up problem can arise between a buyer and a seller when contracts are incomplete and seller investment is buyer specific. In such circumstances there can be too little investment if sellers expect to be held up. There can also be bargaining failure if sellers who do invest refuse to accept "unfair" offers. Our experiment investigates the role of inequality on the hold-up problem by varying the initial endowments of the buyer and sellers. We also investigate the role of culture by comparing behavior of Chinese subjects and US subjects.

1. INTRODUCTION

The hold-up problem is a social dilemma that plays a fundamental role in the modern theory of the firm.[1] It is typically associated with transactions that require non-contractible relation specific investment before transacting parties can determine the final distribution of the resulting surplus. The problem with such investments is that their specificity renders the gains from trade significantly diminished outside the relationship. This prevents buyers and sellers from seeking other trading partners if bargaining breaks down after the investment is sunk. Hold-up arises when a buyer or seller cannot recoup their *ex ante* costs in the *ex post* bargaining stage, which discourages investment resulting in deadweight loss.

Much of the literature on this topic examines how the hold-up problem between selfish agents can be resolved through integration (Klein et al., 1978; Williamson, 1975; 1985; Grossman & Hart 1986), under which transacting parties who were previously at arms-length merge into one firm or organization with a common objective. However, others have a contrasting view that norms regarding fairness and inequality can lead to bargaining behavior that encourages investment at the ex-ante stage (Macneil, 1977); Crocker & Masten, 1991), and laboratory experiments that consider the role of social preferences in the hold-up problem provide some support for these claims (Hackett, 1994). This study builds upon previous experiments by varying the initial endowment subjects receive across treatments to examine the influence of relative income on relation-specific investment and *ex post* bargaining behavior in a hold-up game in two subject populations with salient differences in national culture.

[1] For a review of this topic, see Hart (1995).

In the standard setup, the hold-up game consists of an irretrievable relation-specific investment followed by a bargain over the distribution of resulting surplus. The hold-up game we implement begins with a first mover who can use part of their initial endowment to invest in a surplus worth nothing to themselves but worth more than their cost of investment to a second mover. If the first mover does not invest, the game ends, and each player's payoff is equal to their initial endowment. Should the first mover choose to invest, however, the game progresses to an ultimatum bargaining (Güth & Kocher, 2014) over the surplus in which the second mover makes a take-it-or-leave-it offer to the first mover. If the first mover rejects the offer, then there is no trade, the surplus disappears, and the first mover does not recover their initial cost of investment.

Each session of our experiment includes a one-shot hold-up game between two players. Using a between-subjects design, we vary the relative endowment each player receives across treatments. In each session, subjects submit both first and second mover decisions using the strategy method (Selten, 1967) before roles are randomly assigned and strategies are implemented to determine earnings. This allows us to observe investment decisions and offers from each subject in our sample and compare them across treatments.[2]

With selfish agents, standard backward induction logic predicts that investment will not occur, because the first mover anticipates being "held up" by the second mover. However, individual behavior is often affected by fairness concerns and social norms that may facilitate welfare-enhancing cooperation (Fehr & Schmidt, 2006). For example, subjects in economics experiments regularly invest positive amounts in the investment game (Berg et al., 1995) and reject non-negative offers in the ultimatum bargaining game, even in anonymous one-shot interactions (Güth & Kocher, 2014). Thus, it is not surprising that investment is observed in hold-up experiments despite the pessimistic predictions of game theory.

A number of previous hold-up experiments have examined the influence of social preferences on investment and bargaining behavior. Ellingsen et al., (2004a) implement the hold-up game

[2] To our knowledge, this is the first hold-up experiment implemented with the strategy method. While some researchers argue that the process of thinking through the behavioral implications of each decision node lead them to process their decisions differently (Roth, 1995), research on ultimatum bargaining and investment games suggest that the strategy method does not lead to different experimental results in these settings (Brandts & Charness, 2000, 2011; Johnson & Mislin, 2011).

described above (under a slightly different parameterization). Using the model of inequality aversion proposed by Fehr and Schmidt, (1999), the authors demonstrate that concerns for distributional fairness can resolve the hold-up problem and provide accurate predictions regarding the investment and bargaining behavior they observe. Additionally, Morita and Servatka (2013; 2018) found similar results when implementing the same game and detect a significant increase in investment rates when subjects are primed with group identity.

Other experiments investigate the influence of social preferences on the hold-up problem using different designs. Hackett (1994) implemented a hold-up game with bilateral investment and Nash bargaining and found that subjects abide by implicit surplus sharing rules that reflect each player's relative level of investment. Sloof et al. (2007) implemented a modified hold-up game in which they remove the first mover's decision to accept or reject the second mover's offer and vary the observability of investments to test whether behavior can be explained by positive reciprocity (Dufwenberg & Kirschsteiger, 2004; Rabin, 1993), but they fail to detect a significant difference in behavior across treatments. Dufwenberg et al., (2013) vary the residual rights of control across treatments and show that investment decisions are influenced by the first mover's ability to engage in negative reciprocity (Dufwenberg & Kirschsteiger, 2004) by withholding the asset if bargaining fails.

Here we extend the literature studying the hold-up problem in two ways. First, we vary the relative endowments of the first and second movers, deviating from the standard set up in which both agents start with the same endowment. Second, we conduct our experiment with both US and China subject pools to compare behavior and outcomes across groups with salient differences in national culture.

By providing symmetric endowments (SE) to players in the hold-up game, previous experiments required first movers who chose to invest to enter the bargaining stage behind the second mover by the amount of the investment. While we maintain this design as a baseline treatment, we also study an asymmetric endowment (AE) treatment in which the first mover and second mover enter the bargaining stage with equivalent endowments. Similar to previous experiments examining behavior in the trust game (Rodriguez-Lara (2018); Xiao et al., (2018)), asymmetry can help us distinguish offers intended to reimburse the first mover's cost of investment from those motivated by inequality aversion.

Consistent with previous experiments, investment and bargaining behavior in the hold-up game differ from the predictions of standard theory. Investment rates, offers, and minimum willingness to accept (MWTA) are substantially greater than standard theory predicts, though we fail to detect a significant difference in investment rates, mean offers, mean MWTA, or efficiency in either country. The only significant difference in behavior across endowment conditions is that subjects in both the US and China are more likely to choose offers that reimburse the first mover's cost of investment in SE than in AE, which is consistent with predictions from inequality aversion (Fehr & Schmidt, 1999). However, a substantial portion of subjects in both locations behave in ways that contradict inequality aversion but are consistent with concerns for reciprocity.

We also extend the literature by using distinct subject pools in the US and China. With these diverse populations we are able to compare behavior and outcomes across groups with salient differences in world culture. Previous work has compared behavior across Asian and American cultures, finding significant differences between them in public goods games Gächter, Herrmann & Thöni (2010), trust games (Buchan, Croson & Dawes 2002; Buchan & Johnson et al., 2006), and bargaining games (Chuah et al., 2007; 2009; 2014; Deck, Farmer & Zeng, 2009). We elicit subjects' social preferences in order to determine whether there are cultural differences in behavior that cannot be captured by these simple social preference classifications.

When comparing behavior in our hold-up game across countries, we find that subjects in China make significantly larger offers than subjects in the US and reimburse the first mover's cost of investment at a significantly higher rate. Subjects in China also demand significantly larger offers to engage in trade and this results in similar efficiency and rates of successful trade across countries. These results suggest that subjects in China exhibit a greater concern for reimbursing the first mover's cost of investment than US subjects, which is consistent with previous findings in the investment game (Buchan et al., 2002; Buchan & Johnson et al., 2006)).

The rest of this paper is organized as follows. Section 2 presents our theoretical framework. Section 3 presents out experimental design, and Section 4 presents the formal hypotheses we test in our analysis. Sections 5 and 6 reports the main results from our experiment in our US and China samples, respectively. In Section 7, we pool the data from our US and China samples to compare behavior across endowment conditions and locations. Section 8 concludes with a discussion of our results and directions for future research.

2. THEORETICAL FRAMEWORK

Consider a sequential game between a first and second mover. At stage 1, the first mover can make a fixed, non-contractible investment at cost φ. If the first mover does not invest, the total payoffs of both players are equal to their respective endowments ω_1 and ω_2. If the first mover invests, then there is a joint surplus γ the first and second mover share if they can agree on its distribution such that $\gamma > \varphi$. (In most experiments, including ours, the parameters satisfy $\varphi > \frac{\gamma}{2}$, which implies that dividing the gross surplus leaves the first mover worse off than not investing.) At stage 2, the second mover makes a take-it-or-leave-it offer θ to the first mover which divides the surplus γ. At stage 3, the first mover must either accept or reject the offer. If the first mover accepts the offer θ, the total payoff for the first mover is $\omega_1 + \theta - \varphi$ and the total payoff for the second mover is $\omega_2 + \gamma - \theta$. If the first mover rejects the offer, the surplus is destroyed and the total payoffs to the first and second mover are $\omega_1 - \varphi$ and ω_2, respectively.[3]

This interaction exhibits an inefficiency associated with non-contractible relation specific investment commonly referred to as the hold-up problem. To see this, assume both players are rational payoff maximizers. At stage 1, the first mover will only choose to invest *ex ante* if they believe they will receive an offer greater than or equal to their sunk cost of investment. However, if the first mover chooses to invest, they would be willing to accept any non-negative offer for the second mover at stage 3. Knowing this, the second mover can behave opportunistically and offer $\theta = 0$. Anticipating the second mover's opportunism, the first mover will not invest at stage 1.

Although standard theory assumes agents are selfish, a large literature in economics finds that individuals exhibit other-regarding preferences (see Cooper & Kagel, 2016 for a review). The idea that such preferences can resolve the hold-up problem has received considerable attention,

[3] Figure F.1 in Appendix F provides an extensive form representation of the hold-up game.

and experimental evidence provides some support for this claim (Hackett, 1994; Dufwenberg et al., 2013; Ellingsen et al. 2004b; Sloof et al. 2007). For example, an other-regarding first mover may choose to invest and trade because they prefer efficiency (Charness & Rabin, 2002), or they might receive some altruism payoff (Andreoni 1989) from investing. An other-regarding second mover might also make investment worthwhile for the first mover by choosing an offer $\theta > \varphi$ because of their own altruism or sense of fairness even if the first mover would accept an offer such that $\theta = 0$. Conversely, motivated by their own sense of fairness. first movers may and reject some nonnegative offers that are viewed to be unfair out of spite. Fear that low offers will be rejected could put upward pressure on the second mover's offer and rationalize first mover investment at stage 1.

In this study, we consider the sequential game above under two endowment conditions. In the symmetric endowment condition (denote SE), first and second movers begin the game with respective endowments ω_1 and ω_2 such that $\omega_1 = \omega_2$. This implies that a first mover who invests enters the bargain φ units behind the second mover in the earnings distribution. Players in the asymmetric endowment condition (denote AE) begin the game with endowments such that $\omega_1 = \omega_2 + \varphi$, which implies that an investing first mover enters the bargain with earnings equal to that of the second mover.

While standard theory predicts the same behavior in either case, the difference in initial wealth may influence the behavior of other-regarding agents. For example, previous experiments have shown that a responder's MWTA in the ultimatum game is increasing with their relative earnings (Armentier, 2006), and that individuals exhibit an aversion to being at the bottom of the earnings distribution of their respective group (Kuziemko et al, 2014). By allowing the first mover to begin with a sufficiently larger endowment than the second mover, the first mover will not fall "behind," even if bargaining breaks down. So, we might expect greater investment in AE than SE.

Egalitarian social preferences may also incentivize investment through their influence on the second mover's offer as shown by Ellingsen et al., (2004b). Specifically, they show that a second mover sufficiently averse to advantageous inequality will maximize their utility by choosing an offer $\bar{\bar{\theta}}$ that results in equal payoffs for the pair. We can write the payoff equalizing offer in SE as $\bar{\bar{\theta}} = \frac{\gamma+\varphi}{2}$, which is greater than φ. Otherwise second movers will choose an offer equal to the first mover's MWTA at stage 3, which is weakly less than half of the gross surplus and does not reimburse the first mover's cost of investment.[4]

However, Ellingsen et al., (2004b) only considers cases in which players begin the game with equal endowments which leaves the first mover behind the second mover in the earnings distribution at stage 2. With equal earnings at stage two, the payoff equalizing offer in AE is simply half of the gross surplus which does not reimburse the first mover. Nevertheless, the first mover would accept this offer at stage three since it yields both a higher absolute payoff for themselves and equal payoffs for the pair. This means that inequality aversion can explain offers that reimburse the first mover's cost of investment in SE, but is cannot explain these offers in AE.

Yet another possibility is that agents care about reciprocal fairness independent of the final distribution of payoffs. For simplicity, we assume investment is kind and that reciprocity is violated if the second mover chooses an offer that would leave the first mover worse off than they would have been had they chosen not to invest (for works that take a similar approach, see Coleman (1990)). This implies that a second mover might choose an offer greater than or equal to φ to reciprocate the first mover's kindness, while an offer less than φ might be rejected by a first mover out of spite. Given that endowment heterogeneity has no influence on the first mover's sunk cost of investment, reciprocity can motivate reimbursement in either of our endowment conditions.

3. EXPERIMETNAL DESIGN

All experiment sessions were conducted using the Ztree software (Fischbacher, 2007) the University of Tennessee at Knoxville (UTK) and Southwest Petroleum University in Chengdu, China (SWPU). Subjects in each location were recruited from a variety of introductory courses. A total of 300 subjects (132 at UTK and 168 at SWPU) took part in 25 experiment sessions (11 at UTK and 14 at SWPU) that were conducted between November 2017 and July 2019. Earnings

[4] A first mover will accept any offer of Rejecting an offer greater than this amount at stage 3 results in both a higher absolute payoff and greater disadvantageous inequality than would acceptance.

in both locations were described in terms of experimental currency units (ECU) throughout the experiment and paid in terms of the local currency at a respective conversion rate of \$0.05 and ¥0.15 per ECU. Each session took approximately 45 minutes to complete, and the average earnings for subjects across all sessions was 235 ECU.

At the beginning of each session subjects were instructed not to communicate with one another during the experiment, and informed that time would be provided for questions before subjects made any decisions that may affect their earnings. Written instructions in the *home country's language* were provided prior to each task and read aloud to all participants by the experimenter. Subjects were then randomly sorted into pairs for a one-shot hold-up game between a "first mover" and a "second mover".[5] Using the strategy method, participants submitted decisions as a first and second mover decisions at each node of the hold-up game before the computer randomly assigned roles at random to determine earnings. This allows us to observe 300 unique observations regarding investment decisions and offers that can be used to compare behavior across treatments.

Subjects submitted their strategies for the hold-up game with their mouse and keyboard on two decision screens. On their first decision screen, subjects stated the strategies they would like to play if assigned the role of first mover. Each subject stated whether they would like to invest 60 ECU at stage 1 in surplus worth 90 ECU to the second mover but worth 0 ECU to themselves. If they chose not to invest, no other decision was made on the first decision screen. If they chose to invest, subjects were also asked to state the smallest offer they would be willing to accept (MWTA) from their match at stage 3. Once all subjects submitted their decisions, the computer program progressed each subject to their second decision screen.

On the second decision screen, subjects stated the strategies they would like to play if assigned the role of second mover. Each subject stated the offer they would like to send at stage 2 if their match chose to invest. Once each subject submitted their decision, the computer assigned roles at random within each pair to calculate earnings.

[5] On both the written instructions and the prompts on their computer screens, the subject with whom one was paired was referred to as their "match".

Earnings for the hold-up game were determined as follows. If the first mover chose not to invest, the first and second mover receive a payoff equal to their respective endowment. If the first mover chose to invest, 60 ECU was subtracted from their endowment and the bargain was implemented. If the second mover's offer was greater than or equal to the first mover's MWTA, the first mover received a payoff of equal to their endowment minus 60 ECU plus the second mover's offer, and the second mover received a payoff equal to their endowment plus 90 ECU minus their offer. If the second mover's offer was less than the first mover's MWTA, the first mover received a payoff equal to their endowment minus 60 ECU, and the second mover received a payoff equal to their endowment.

The endowments assigned to first and second movers varied across sessions in each location. In our symmetric endowment condition (SE), both first and second movers received an endowment equal to 100 ECU. In our asymmetric endowment condition (AE), first mover received an endowment 60 ECU greater than the second mover's endowment.[6]

Before learning any of the outcomes from the hold-up game, subjects took part in a lottery task from Eckel and Grossman (2008) and an augmented dictator game from Charness and Rabin (2002) to elicit risk and social preferences, respectively.[7] Once subjects completed these tasks, we asked them to fill out a post experiment questionnaire before receiving their earnings privately in cash on their way out of the lab.

4. HYPOTHESES

According to standard theory, the outcome of the hold-up game is not a function of relative wealth. Since previous work has argued that social preference theories based on relative payoff utility measures can explain deviations from standard theoretical predictions, we ask whether heterogeneity in endowments will influence individual behavior and group-level outcomes in this

[6] Originally, there were two asymmetric endowments conditions. In the "first-mover-high" (or FMH) condition, the first mover received an endowment equal to 160 ECU and the second mover was assigned an endowment of 100 ECU. In the "second-mover-low" (or SML) condition, the first mover received an endowment equal to 100 ECU and the second mover received an endowment equal to 40 ECU. Because behavior in each within each location was nearly identical in FMH and SML conditions, we pooled these observations within each location under AE. For more details, see Tables F.2, F.3, and F.4 and in Appendix F.

[7] In Appendix F, Tables F.5 and F.6 provide the decisions facing subjects in each task along with country specific means for each response.

decision setting. To do this, we compare individual behavior and group-level outcomes in the hold-up game across our symmetric and asymmetric endowment conditions. Then we investigate whether the culture affects behavior, controlling to some extent for social preferences, by comparing the behavior of subjects from two different subject pools with salient differences in national culture (students in the US and China). In subsections 4.1 and 4.2 respectively, we discuss our hypotheses regarding each of these comparisons and test them in Section 5.

4.1 Endowment conditions

Individual behavior in our experiment is captured by each subject's investment decision as a first mover at stage 1, each subject's offer decision as a second mover at stage 2, and the MWTA at stage 3 from each subject that chose to invest as a first mover. According to standard theory, these decisions are not a function of relative wealth and predicts that these decisions will not differ significantly across endowment conditions. We summarize these predictions below, in Hypotheses 1, 2, and 3.

Hypothesis 1. For both locations, investment rates in SE and AE will be the same.

Hypothesis 2. For both locations, offers in SE and AE will be the same.

Hypothesis 3. For both locations, the MWTA in SE and AE will be the same.

We additionally investigate the frequency with which the second mover chooses an offer that fully reimburses the first mover's investment. Consistent with the notion of "reciprocity" discussed in the introduction (Coleman, 1990), we report average rates of *reimbursement*, the percentage of offers that equal or exceed the cost of investment (60). Equals rates of reimbursement is implied by Hypothesis 2, and so we do not state this as an additional hypothesis.

Now that we've addressed behavior at the individual level for all three stages of the hold-up game, we turn our attention to the efficiency of outcomes at the group level. According to standard theory, group earnings in both endowment conditions will not change and thus be the same across treatments. We summarize this prediction below in Hypothesis 4.

Hypothesis 4. For both locations, group-level earnings and the rate of bargaining success (conditional on investment) will each be the same across the SE and AE conditions.

From our discussion in Section 2, we know that social preferences could explain some deviations from these hypotheses. For example, inequality aversion clearly predicts that some subjects will choose offers that result in equal payoffs which reimburse the first mover in SE but not AE. To address this, we take a look at offer distributions to see if subjects chose such offers in either treatment. We also report average rates of *reimbursement*, the percentage of offers that equal or exceed the cost of investment (60), and compare them across endowment conditions. However, since equals rates of reimbursement is implied by Hypothesis 2, and so we do not state this as an additional hypothesis.

4.2 US and China sessions

Next, we address the potential for differences in behavior across sample populations in the US and China. Economic theory assumes that behavior in the hold-up game is invariant to differences in national culture. However, the international business literature finds that Chinese and American cultures respectively, rank among the most collectivistic and individualistic cultures in the world,[8] and researchers find that these sentiments can have a significant influence on organizational behavior (Hofstede 1980; 1984; Hofstede 2011; Triandis 1998).

Like many collectivist cultures, tacit reciprocal obligations are the norm in China and are well understood by American executives with experience working in the region (Fock & Woo 1998).[9] Meanwhile, individualist cultures (like the US) view positive reciprocity as desirable but not to be expected from oneself or others without an explicit agreement a priori (Hofstede, 2001). This is one-way researchers explain their finding that managers in China are less reliant than others on

[8] Out of 76 countries investigated, Hofstede et al. (2011) rank the United States as the most individualistic national culture followed by Australia and the UK (two other nations with Anglo-Saxon roots), while China was ranked as the most collectivistic.

[9] Specifically, researchers call attention to the Chinese concept of *guanxi* (Chen, Chen & Huang 2013; Yang, 2016), which refers to social norms that stress the importance of maintaining social harmony in relationships through cooperation and reciprocal obligations between parties in pursuit of mutually beneficial exchange (Luo, Ying & Wang, 2012). While western conceptions of trust rely on individual beliefs regarding the goodwill of others (Yagamashi & Yagamiashi, 1994), guanxi establishes norms for positive reciprocity more akin to assurance in exchange relationships (Standifird & Marshall, 2000). As Park and Luo (2001) note, "the rules of reciprocity in guanxi establish a structural constraint that curtails self-seeking opportunism," helping firms acquire crucial resources and overcome institutional shortfalls.

detailed contracts or formal institutions to achieve efficiency in relational exchange, and firms in the US and Western Europe invest considerable resources into both (Luo, 2007; Xin & Pearce, 1996).

Cross-cultural experiments work in the economics literature have also found that subjects in China tend to exhibit more cooperation and positive reciprocity than those from Anglo-American cultures. For example, both Buchan et al. (2002) and Buchan & Johnson et al. (2006) find that Chinese second movers in the investment game send larger amounts back to investors and send positive amounts at a higher rate which demonstrates a greater tendency toward positive reciprocity. Chuah et al. (2007; 2009) find that subjects in China make significantly larger offers as proposers in the ultimatum game, while others have found that Chinese subjects exhibit greater rates of cooperation in prisoner's dilemmas (Hemesath & Pomponio, 1998; Wong et al., 2005).

For the reasons discussed above, it would not be surprising to find differences in behavior across cultures. We nevertheless maintain the predictions of standard economic theory as our baseline hypotheses, which is that there should be no difference in behavior across countries.

Hypothesis 5: Investment rates in the US and China will be the same.

Hypothesis 6. Offers in the US and China will be the same.

Hypothesis 7. The MWTA for subjects in the US and China will be the same.

Hypothesis 8. Group-level earnings and the rate of bargaining success (conditional on investment) will be the same across the US and China.

The following section reports results testing Hypotheses 1 through 4 using data from subjects in the US and China, respectively. Then we use observations from both locations to further test Hypotheses 1-4, and to test Hypotheses 5-8 by comparing behavior and outcomes across locations.

5. RESULTS

5.1 US Sessions

Table E.1 reports US sample means regarding individual behavior in the hold-up game from our symmetric (USE) and asymmetric (UAE) endowment conditions. Here we can see that 31 of the 68 subjects in USE chose to invest as first movers which yields an investment rate of 45.6%. At stage 3, these subjects required an average of 45.6 ECU MWTA to engage in trade. The average offer chosen in USE was 49.9 ECU, and 48.5% of these offers were greater than or equal to the first mover's cost of investment.

In UAE, we find that 35 of 64 subjects chose to invest as first movers yielding an investment rate of 54.7%. On average, investing subjects demanded 47.3 ECU to engage in trade at stage 3. Subjects in UAE offered an average of 49.8 ECU, and only 28.8% of these offers were greater than or equal to the first mover's cost of investment. Distribution plots of Offers and MWTA across endowment conditions for our US sample can be found in Figure E.1.

We can see from Table E.1 shows that subjects in UAE invested at a higher rate than those in USE. However, a two-sample Fisher's exact test of proportions reveals that this difference in investment rates across endowment conditions is not significant (two-sided p-value = 0.296). So, the US data fails to reject our first hypothesis.

Finding 1: Subjects chose to invest at similar rates in USE and UAE.

Our second hypothesis states that subjects will choose similar offers across endowment conditions. Referring again to Table E.1 we see that the mean offer was similar for US subjects across endowment conditions, though a larger proportion of offers in USE would reimburse the first mover's cost of investment. An unequal variances *t*-test rejects the alternative hypothesis that mean offers were unequal across endowment conditions (p-value = 0.973). However, if we take a look at the offer distributions in Figure E.1, we can see that the mode of each distribution, respectively, is equal to the payoff equalizing offer (75 ECU in SE; 45 ECU in AE). This shift is reflected in the reimbursement rates reported in Table E.1, and two-sample Fisher's exact test of proportions finds that the difference in reimbursement rates across endowment conditions is statistically significant at the 5% level (two-sided p-value = 0.016).

Finding 2: The reimbursement rate was larger in USE than in UAE. However, mean offers were similar in USE and UAE.

We also hypothesized that investing subjects would require similar offers (MWTA) across endowment conditions to engage in trade. Table E.1 shows that subjects in UAE required an average of only 1.7 ECU more that subjects in USE. An unequal variances *t*-test reveals that the difference in mean *MWTA* across USE and UAE is far from significant (p-value =0.676). Therefore, the US data fails to reject Hypothesis 3.

Finding 3: Means for MWTA were similar in USE and UAE.

The subgame perfect prediction of the hold-up game is that efficient investment will not take place. To test Hypothesis 4, we consider the change in group earnings associated with each outcome, Δ*Group Earnings*, and compare it across endowment conditions. Recall that "No Investment" leaves both players with their respective endowments (Δ*Group Earnings* = 0), "Successful Trade" increases earnings for the pair by the net surplus from investment (ΔGroup Earnings = +30 ECU), and "Bargaining Failure" conditional on investment decreases earnings for the pair by the first mover's cost of investment (Δ*Group Earnings* = −60 ECU). Thus, conditional on investment, buyers and sellers must reach an agreement in more than two thirds of the time in order to achieve greater efficiency than theory predicts.

Figure E.2 plots a histogram of outcomes for the hold-up game from US sessions, and here we see little difference across endowment conditions.. In Table E.2, we report mean estimates of Δ*Group Earnings* derived from a linear regression using the 132 iterations of the hold-up game (recall that each subject made decisions as a first mover and a second mover) that we observe in our US sample. It is important to note that these observations are not independent given that each outcome of the hold-up game depends on the decisions made by both subjects within a given pair. To account for this when comparing outcomes across treatments, we cluster the standard errors by pair.

Our fourth hypothesis addresses efficiency across endowment conditions, which is measured by the average change in group earnings. We find that Δ*Group Earnings* decreased by approximately 4.9 ECU in USE, while group earnings decreased by 1.9 ECU in UAE. However, a Wald test fails to detect a significant difference in means across endowment conditions (p-value = 0.630). Thus, we find no difference in efficiency across endowments.

In addition to Δ*Group Earnings*, Table E.2 reports the rate at which stage 1 investments resulted in successful trade (*Successful Trade*). Here we can see that 54.8% of investments made by US subjects in SE result in successful trade, while 62.9% of investments from AE result in successful trade. A Wald test comparing these rates across endowment conditions fails to reject the null hypothesis of equality (p-value = 0.553). Thus, we do not find that US subject pairs were significantly more or less likely to trade successfully in either endowment condition.

Finding 4: Group-level earnings and the rate of bargaining success (conditional on investment) were similar in USE and UAE.

After the hold-up game, subjects in each session completed the lottery and sequential dichotomous dictator tasks. Table E.3 reports US sample means for the risk and social preference parameters we derived from their responses in each task, respectively. Since individual decisions in the hold-up game influence earnings for the pair and are made prior to learning those of one's trading partner, we examine the extent to which behavior in the hold-up game is related to the risk and social preference parameters we elicited from subjects in each session using regression analysis.[10]

Results from linear regressions with a dummy variable for *Invest* on the left-hand side and a fixed effect for UAE on the right-hand side of each regression are reported in Table E.4, while additional controls for risk and social preferences differ across specifications. Here we find that the effect of UAE in our US sample is insignificant across all specifications. We also fail to detect a significant difference in investment associated with gender, risk aversion, prosocial preferences, inequality aversion or competitive social preferences.

[10] The leftmost column of Table E.3 reports two-sided Fisher's exact p-values from comparisons of each proportion across endowment conditions in our US sample. Given that each of these p-values is greater than or equal to 0.201, we find that US subjects exhibit similar risk and social preferences across endowment conditions.

To investigate the factors affecting *Offer* we provide linear regressions with it as the dependent variable in Table E.5. Each regression includes a fixed effect for UAE while additional controls vary across specifications. Much like the results reported in Table E.4, we fail to detect a significant difference in means for *Offer* across treatments, and we fail to detect a significant relationship between *Offer* and our preference parameters. We also investigate the potential relationship between *Offer* and the subjects' investment decision as a first mover, but fail to detect a significant relationship between the two.

Our hypotheses do not specifically address the likelihood that a second mover will reimburse the first mover for the cost of the investment by making a fully reimbursing offer that is greater than or equal to 60. Nevertheless, we found a highly treatment effect on such reimbursing offers. To investigate the robustness of this such behavior, Table E.6 reports results from linear regressions similar to those in Table E.5, but with *Reimburse* as the dependent variable in each specification. We fail to detect a significant relationship between *Reimburse* and our preference parameters individually, or when include multiple controls in other specifications. However, we do find that the coefficient associated with our asymmetric endowment treatment is negative and statistically significant at the 5 percent level (all p-values < 0.022) across model specifications. These results provide further support for Finding 2, that second movers were less likely to fully reimburse first movers in the asymmetric endowment treatment UAE.

Finally, we conclude this section by examining the potential relationships of an investing first movers minimum willing to accept with risk preferences, social preferences, and their offers as second movers. Here we find results from linear regressions with *MWTA* as the dependent variable. Again, we fail to detect a significant relationship between *MWTA* and our preference parameters. However, Specification 5 in Table E.7 examines the relationship between *Offer* and *MWTA*, and estimates a positive and significant correlation between the two (p-value = 0.001). This effect is robust to controls for risk preferences, social preferences as well as gender, and we examine this relationship further in Figure E.3.

Figure E.3 presents a two-way scatter plot of (*Offer*, *MWTA*) for our US sample, along with a linear prediction of *MWTA* conditional on *Offer*. Here we can see an upward trend in *MWTA* as *Offer* increases, and this intuition is confirmed by a positive and significant slope coefficient (p-value = 0.000) and a Spearman's rank correlation test between the two variables (p-value = 0.000). Thus, it appears that a larger *MWTA* as an investing first mover is associated with a choosing a larger offer for one's partner as a second mover.

5.2 China Sessions

In this section we test our hypothesis using the data collected from subjects in China. Table E.8 reports China sample means regarding individual behavior in the hold-up game from each endowment condition. Here we can see that 41 of the 72 subjects in CSE (56.9%) chose to invest as first movers and these subjects required an average of 57.5 ECU to engage in trade. The average offer chosen in CSE was 60.5 ECU, and 68.1% of these offers were greater than or equal to the first mover's cost of investment. In AE, we find that 52 of 96 subjects in China chose to invest as first movers yielding an investment rate of 54.2%. On average, investing subjects demanded 54.3 ECU to engage in trade at stage 3, while subjects in CAE offered an average of 56.3 ECU to the first mover. Distribution plots of Offers and MWTA across endowment conditions for our China sample can be found in Figure E.4.

In our China sample, subjects in SE invested at a higher rate than those in AE. However, a two-sample Fisher's exact test of proportions reveals that this difference in investment rates across endowment conditions is not significant (p-value = 0.720).

Finding 5: Subjects chose to invest at similar rates in CSE and CAE.

Our second hypothesis states that subjects will choose similar offers across endowment conditions. Table E.8 shows that the average offer in CSE was 4.2 ECU higher than it was in CAE, and that a larger proportion of offers in CSE would reimburse the first mover's cost of investment. An unequal variances *t*-test fails to reject the null hypothesis that offers were equal across endowment conditions (p-value = 0.172). However, if we take a look at the offer distributions in Figure E.4, we can see that the frequency of offers equal to 45 ECU increases from SE to AE which if the payoff equalizing offer when endowments are asymmetric. This shift is reflected in the reimbursement rates reported in Table E.4, and a two-sample Fisher's exact test of proportions finds that the difference in reimbursement rates across endowment conditions is significant at the 5% level (two-sided p-value = 0.037).

Finding 6: The reimbursement rate was significantly greater in CSE than CAE. The mean offer was also larger in CSE than CAE, but the difference is not significant.

We also hypothesized that investing subjects require similar offers across endowment conditions to engage in trade at stage 3. Referring to Table E.8 we can see that the average MWTA in CSE was 3.2 ECU larger than in CAE. An unequal variances *t*-test fails to reject the null hypothesis that the mean *MWTA* is equal across endowment conditions (p-value = 0.452). Therefore, the China data also fails to reject Hypothesis 3.

Finding 7: Means for MWTA were similar in CSE than in CAE.

Now we shift our attention to the outcomes of our hold-up game. Figure E.5 shows the proportion of matches in our China sample that ended with no investment, successful trade and bargaining failure across endowment conditions. As noted previously in Finding E.5, subjects in China exhibited similar rates of investment across endowment conditions which implies a similar proportion of games ending with no investment. Of the subjects who did choose to invest, the game concluded with successful trade or bargaining failure.

Our fourth hypothesis addresses efficiency across endowment conditions. To test Hypothesis 4 with our China subject pool, we consider the change in group earnings associated with each outcome (Δ*Group Earnings*) and compare Δ*Group Earnings* across endowment conditions. Table E.9 reports the average change in group earnings for subjects in CSE and CAE, respectively. Mean estimates of Δ*Group Earnings* are derived from a linear regression using the 168 iterations of the hold-up game that we observe in our China sample. It is again important to note that these observations are not independent given that each outcome of the hold-up game depends on the decisions made by both subjects within a given pair.

Figure E.5 plots a histogram of outcomes for the hold-up game from China sessions, and here we see little difference across endowment conditions. Referring to Table E.9 we can see that the group earnings for each pair in China decreased by approximately 4.2 ECU in SE, while group earnings decreased by 3.4 ECU in AE. A Wald test fails to detect a significant difference in means across endowment conditions (p-value = 0.897).

In addition to Δ*Group Earnings*, Table E.9 reports the percentage of successful trades in our China sample (*Successful Trade*). Here we can see that 58.5% of investments made by subjects in CSE result in successful trade, while 59.6% of investments from CAE result in successful trade. A Wald test comparing these rates across endowment conditions fails to reject the null hypothesis of equality (p-value = 0.916). Thus, we do not find that subject pairs in China were significantly more likely to bargain successfully in either endowment condition.

Finding 8: Group-level earnings and the rate of bargaining success (conditional on investment) were similar in CSE and CAE.

Next, we examine the extent to which behavior in the hold-up game can be explained by the risk and social preference parameters elicited from subjects.[11] Table E.11 reports results from linear regressions with a dummy variable for investment on the left-hand side and a fixed effect for subjects in CAE on the right-hand side of each regression, while additional controls for risk and social preferences differ across specifications. Here we can see that the coefficient associated with CAE is not significant for any of our model specifications. Social preferences have no consistent impact across specifications, although inequality aversion and competitiveness have negative effects on investment in a few specifications. The only significant estimate is found in Specification 5, in which male subjects appear to invest at a significantly lower rate than female subjects.

To shed some light on the factors influencing *Offer*, we report results from linear regressions with this as our dependent variable in Table E.12. Each regression includes a fixed effect for CAE while additional controls vary across specifications. Here we can see that the estimated coefficient associated with CAE is positive but insignificant across model specifications (all p-values > 0.310). Additionally, none of the estimates associated with our controls for risk aversion, social preferences or gender reach significance. The only significant relationship revealed in Table E.12 is the positive correlation between *Invest* and *Offer.* We estimate a

[11] Table E.10 reports China sample means for the risk and social preference parameters. The leftmost column of Table E.10 reports two-sided Fisher's exact p-values from comparisons of each proportion across endowment conditions in our China sample. Given that each of these p-values is greater than or equal to 0.393, we find that subjects in China exhibit similar risk and social preferences across endowment conditions.

positive linear effect associated with *Invest* that is highly significant and robust to controls for risk aversion, social preferences and gender (all p-values <0.04).

Panels I and II of Figure F.2 plot the offer distributions of subjects who choose to invest and those who do not in the SE and AE treatments, respectively. Here we can see that, in both endowment conditions, the offer distribution for subjects that invest lies below the offer distribution of those who don't invest. A two-sample Mann-Whitney rank-sum test detects a significant difference in offers for both endowment conditions (CSE p-value = 0.046; CAE p-value = 0.049).

To examine the potential relationships between our preference parameters and reimbursement rates, we report results from linear regressions in Table E.13 with *Reimburse* as the dependent variable. Much like the results reported in Tables E.11 and E.12, we fail to detect a significant relationship between *Reimburse* and our preference parameters individually, or when include multiple controls in other specifications. However, we do find that the coefficient associated with our asymmetric endowment treatment is negative and significant across model specifications. These results provide further support for Finding 6, indicating that the difference in reimbursement rates across endowment conditions is robust to controls for gender, risk aversion, and social preferences.

We conclude this section by examining the potential relationships of an investing first movers the MWTA with risk preferences, social preferences, and their offers as second movers. Table E.14 reports results from linear regressions with MWTA as the dependent variable. Much like our previous results, we fail to detect a significant relationship between *MWTA* and our demographic controls individually. Much like for our US data, Offer continues to be slightly positively correlated with MWTA. Competitive has a significant positive effect in many but not all of the specifications.

To illustrate this relationship, Figure E.6 presents a two-way scatter plot of (*Offer*, *MWTA*), along with a linear prediction of *MWTA* conditional on *Offer*. Here we can see an upward trend in *MWTA* as *Offer* increases, and this intuition is confirmed by the significance of our slope coefficient (p-value = 0.093) and a Spearman's rank correlation test between the two variables (p-value = 0.001). Thus, it appears that subjects in China with a larger *MWTA* as an investing first mover also chose larger offers for their trading partner as a second mover.

5.3 Cross-Country Comparisons

In this section we investigate cross country differences in behavior and outcomes. Table E.15 compares average behavior across US and China subject pools for the symmetric endowment treatment (SE) and asymmetric endowment treatment (AE). Recall that, consistent with standard economic theory, our baseline hypothesis is that behavior will be similar across locations. Hypothesis 5, in particular, states that subjects in China will invest at the same rate as US subjects across endowment conditions. Table E.15 shows subjects in CSE invested at a higher rate than subjects in USE, but this difference is not statistically significant (two-sided Fisher's exact p-value = 0.179). And there is essentially no difference in investment rates across CAE and UAE (p-value = 0.919). We are unable to reject Hypothesis 5.

Finding 9: Subjects chose to invest at similar rates across locations.

Our sixth hypothesis considers the difference in offers across locations. It states that the offers made by subjects in our China sessions will be similar to those made by subjects in our US sessions, but this is not what we find. Table E.15 shows that the average offer chosen by subjects in China was larger than those chosen by US subjects in both endowment treatments, respectively. In each case, an unequal variances *t*-test finds that the difference in offers across locations is statistically significant (SE p-value = 0.004; AE p-value = 0.018). The same is also true with respect to reimbursement rates with subjects in China choosing offers greater than the first mover's cost of investment at a significantly higher rate in SE (two-sided Fisher's exact p-value = 0.019), AE (two-sided Fisher's exact p-value = 0.003). Thus, we reject Hypothesis 6.

Finding 10: Subjects in China chose significantly larger offers and reimbursed the first mover's cost of investment at significantly higher rate than US subjects in both endowment conditions.

Our seventh hypotheses states that the MWTA of subjects who chose to invest as first movers will be similar across locations. In contrast with this hypothesis, Table E.15 shows that subjects in China require larger offers to engage in trade at stage 3 than US subjects in both endowment conditions. An unequal variances *t*-test reveals that the difference in MWTA is significant in both SE (p-value = 0.018) and AE (p-value = 0.044). We therefore reject Hypothesis 7.

Finding 11: Subjects in China who invested required larger offers (MWTA) to engage in trade than US subjects in both endowment conditions.

Now we turn our attention to Hypothesis 8, which states that the efficiency of group level outcomes will be equivalent across locations. Table E.16 reports results from linear regressions with Δ*Group Earnings* and *Successful Trade* respectively, as the dependent variable. We use dummy variables to estimate mean differences across locations in each of our endowment treatments and cluster standard errors by pairs.[12]

The estimates in Table E.16 show that, on average, Δ*Group Earnings* was greater for subject pairs in China than it was for subjects in the US in both symmetric and asymmetric endowment settings. However, we fail to detect a significant difference in Δ*Group Earnings* across locations in either endowment condition (SE p-value = 0.897; AE p-value = 0.971). Below our estimates for Δ*Group Earnings*, we report results from regressions comparing *Successful Trade* across locations and find similar results. A larger proportion of investments from subjects in CSE result in successful trade, while the opposite is true in AE. Once again, our results reveal that the rate of successful trade does not differ significantly across locations in either our symmetric endowment treatment (p-value = 0.755) or our asymmetric endowment treatment (p-value = 0.975). Thus, we are unable to reject Hypothesis 8.

Finding 12: Group-level earnings and the rate of bargaining success (conditional on investment) were similar in the US and China.

Our findings above suggest that bargaining behavior differed significantly across locations in both endowment conditions, but that these differences did not result in significantly different outcomes with respect to efficiency. Now that we've tested our main hypothesis of interest across locations, we consider whether differences we do observe across locations can be explained by differences in either risk or social preferences. To do this, we first compare the risk

[12] For a more detailed description of the regression models used to derive our estimates, see the notes below Table E.16.

and social preferences parameters derived from our lottery task and sequential dictator game across locations. Then we employ regression analysis and capture differences in behavior across locations with dummy variables.

Sample means of each preference parameter for each location are reported in Table E.17. Here we can see that a two-sample Fisher's exact test of proportions finds that *Risk Aversion* is statistically equivalent across locations (p-value = 0.743). Examining decisions in our social preference elicitation, we see significant differences across locations. For example, while 32.7% of subjects in China exhibited a prosocial preference for efficiency, in contrast with 58.33% of US subjects and this difference in proportions is highly significant (two-sided Fisher's exact p-value = 0.000). The small difference in the percentage of inequality averse agents across countries is not statistically significant (p-value = 0.687). However, we also find a larger proportion of subjects in China exhibit competitive social preferences and this difference is statistically significant (two-sided Fisher's exact p-value = 0.017).

Given our results in Table E.17, we use regression analysis to examine behavior in the hold-up game across locations while controlling for differences in preference parameters. Tables E.18-21 reports results from linear regressions with *Invest, Offer, Reimburse,* and *MWTA* as our dependent variables, respectively. In each model specification, we include a fixed effect for our asymmetric endowment treatment. This allows us to capture cross-country differences in hold-up game behavior in each endowment treatment with interaction terms *China*SE* and *China*AE*.

The first cross country comparison we examine is the difference in investment rates. Table E.18 reports linear regressions with *Invest* as our dependent variable. As was true above, we fail to detect a significant difference in investment rates across locations. Additionally, the preference parameters do not provide much explanatory power, though there is weak evidence that inequality averse and competitive preferences are associated with a lower probability of investment.

Next, we take a look at our regression analysis with respect to offers in Table E.19. Here we find that mean difference in *Offer* between subjects in China and the US remain positive and statistically significant in each endowment condition across locations (all p-values <0.041). We fail to detect a significant relationship between *Offer* and any of our demographic controls for gender, risk aversion, or social preferences. In Specifications 6 and 7, we estimate a significant and positive coefficient associated with investment (p-value = 0.004) that remains significant in subsequent specifications when additional preference and gender controls are included on the right-hand side.

In addition to *Offer*, we would also like to investigate the factors affecting the probability that a second mover's offer fully reimburses the first mover's cost of investment (60). To do this, we report results from linear regressions results *Reimburse* as our dependent variable in Table E.20. These results show that the previously documented differences in Reimbursement frequency across endowment treatments and countries are robust after controlling for risk and social preferences.

Finally, we take another look at the differences in *MWTA* across locations and test whether these differences are robust to our controls for risk and social preferences. Table E.21 reports results from regressions with *MWTA* as our dependent variable. Here we can see that the differences in *MWTA* between CSE and the baseline USE are robust after controlling for gender, risk preferences, and social preferences. The difference in *MWTA* between CAE and the baseline UAE are robust controls for risk preferences (p-value = 0.092) and inequality aversion (p-value = 0.089), but this difference is no longer significant when controls for competitive (p-value = 0.146) or prosocial preferences (p-value = 0.160) are included. Specifications 6 and 7 report a positive and significant estimated coefficient associated with *Offer* (p-value = 0.000).

Taken together, the results from our regression analysis show that Findings 9 and 10 are robust to our controls for risk and social preferences. We also find that the difference in MWTA across locations in our symmetric endowment treatment reported in Finding 11 is robust to these controls, though the difference observed in our asymmetric endowment treatment loses significance when we account for prosocial and competitive social preferences. Specifically, we find that the smaller mean MWTA for subjects in UAE (relative to CAE) can be partially explained by their prosocial preference for efficiency, and the relatively large mean MWTA for subjects in CAE can be partially attributed to their competitiveness.[13] The fact that we observe

[13] The sample variances in both USE and CSE are larger than those in UAE and CAE, respectively. A variance ratio test finds that the difference in variance across endowment conditions is marginally significant in both our US sessions (p-value = 0.098) and China sessions (p-value = 0.074). Thus, it could be the case that we simply need a

this mediation effect in one endowment treatment and not the other may be due to the relatively low variance of MWTA in our asymmetric endowment treatment. Nevertheless, our estimates show that there are differences in bargaining behavior across locations that can be explained by differences in national culture, independent of risk and social preferences.

6. CONCLUSION

This paper has attempted to investigate investment and bargaining behavior in the hold-up game with two new design contributions. We implement a one-shot hold-up game under symmetric and asymmetric endowments conditions in two countries with salient differences in culture. Our findings show that subjects in both countries were unable to overcome the hold-up problem across treatments, with a negative change in earnings on average, less than the theoretical prediction of no investment and no change.

Consistent with standard theory, heterogeneous endowments had only minor effects on behavior. The only significant difference across endowment conditions is a smaller reimbursement rate in AE than SE, and we observe this in both locations. The direction of this result is consistent with inequality aversion, and a closer look at the distribution of offers shows that a considerable proportion of subjects in each location chose offers that would results in equal payoffs for the pair. However, we still observe a considerable proportion of offers that reimburse the first mover's cost of investment in AE, which can be explained by reciprocity but not inequality aversion. From this we conclude that both motives can explain much of what we observe in the hold-up game at the individual level, but their presence did not result in greater efficiency.

When examining first and second mover decisions across locations, we find that subjects in our US and China sessions invest at similar rates but exhibit significant differences in bargaining behavior that are robust to our controls for risk and social preferences. Our results show that second movers in China made larger offers than their US counterparts in both treatments, and that they chose offers that reimbursed the first movers cost of investment at a higher rate. We also find that the first movers in China demanded larger payments to engage in trade at stage 3,

larger sample in our asymmetric endowment treatment to identify the difference in MWTA across locations, independent of prosocial and competitive social preferences.

which is why we observe similar rates of bargaining failure and similar group earnings across locations. These differences are consistent with previous experiments (Buchan et al., 2002; 2006)) finding subjects in China exhibiting greater concern for reciprocity than US subjects, but our findings suggest that this does not translate into greater efficiency in the hold-up game.

In addition to comparing behavior across our four treatment conditions, we also report some interesting results regarding first and second mover behavior in experimental hold-up games. For instance, subjects who invest as first movers make larger offers than those who don't. We also find that investing subjects in both locations who make larger offers also demand larger offers to engage in trade at stage 3. These results are consistent with previous experiments that find subjects who exhibit trust also exhibit trustworthiness (Johnson & Mislin, 2011), and that cooperative subjects have higher expectations regarding the cooperativeness of others (Guth et al., 2014; Sapienza et al., 2013).

To conclude, we agree with Chuah et al. (2007; 2009) and Deck, Farmer and Zeng (2009) that in an increasingly globalized market place, more research is needed to better understand cultural differences bargaining and organizational behavior. We believe that our paper provides a contribution along these lines and hope our results motivate future research on these topics.

APPENDIX E: Tables and Figures

Table E.1: Summary Statistics (US)

	USE	UAE	p-value
Investment Rate	31/68 = 45.6%	35/64 = 54.7%	(0.296)
Mean Offer	49.9 ECU	49.8 ECU	(0.973)
Reimbursement Rate	33/68 = 48.5%	18/64 = 28.8%	(0.016)
Mean MWTA	45.6 ECU	47.3 ECU	(0.676)

Notes: Means for each strategy chosen by *US* subjects in the hold-up game are reported for each endowment condition. The p-values associated with *Invest* and *Reimburse* are derived from two-sample Fisher's exact tests of proportions with the null hypothesis of equality across endowment conditions. The p-values associated with *Offer (mean)* and *MWTA (mean)* are derived from Welch's *t*-tests.

Table E.2: Earnings and Successful Trade (US)

	USE	UAE	Obs.	Clusters	p-value
Δ Group Earnings	-4.9 ECU	-1.9 ECU	132	66	(0.630)
Successful Trade | Invest = 1	54.8%	62.9%	66	46	(0.553)

Notes: US sample means for each variable are reported across endowment conditions. Means for "Δ Group Earnings" are derived from the linear regression $\Delta GroupEarnings_i = \beta_0 * SE_i + \beta_1 * AE_i + \epsilon_i$ where $\Delta GroupEarnings_i$ is the change in group earnings associated with the iteration of the holdup game associated with player i*'s* first mover decisions, SE_i is an indicator equal to 1 if player *i* took part in SE, AE_i is an indicator equal to 1 if player *i* took part in AE, and ϵ_i is the standard error clustered by pair. Means for "Successful Trade | Invest = 1" from similar regressions, but only uses observations for which subject *i* chose to invest as a first mover. p-values are derived Wald-tests comparing estimates across endowment conditions.

Table E.3: Risk and Social Preferences (US)

	USE	UAE	p-value
Risk Averse	73.5%	71.9%	(0.831)
Prosocial	51.5%	62.5%	(0.201)
Inequality Averse	19.1%	15.6%	(0.597)
Competitive	13.2%	10.9%	(0.686)

Notes: US sample means for each variable are reported across endowment conditions. (p-values are derived two-sample Fisher's exact tests of proportions with the null hypothesis of equality across endowment conditions)

Table E.4: Linear Regressions on "Invest" (US Data)

	[1]	[2]	[3]	[4]	[5]
AE	.09	.09	.09	.09	.09
	(.09)	(.09)	(.09)	(.09)	(.09)
Risk Averse	.04				.03
	(.10)				(.1)
Prosocial		.04			-.05
		(.09)			(.13)
Ineq. Averse			-.07		-.12
			(.12)		(.16)
Competitive				-.07	-.13
				(.13)	(.18)
Male					-.05
					(.09)
Constant	$.43^{***}$	$.44^{***}$	$.47^{***}$	$.46^{***}$	$.53^{***}$
	(.09)	(.08)	(.06)	(.06)	(.16)

Notes: Estimates are derived from the linear regression $Invest = \beta X + \epsilon$ where our dependent variable is an indicator variable for investment, X is our matrix of independent variables, and ϵ is a matrix of i.i.d. error terms. Only observations from our US sample are included. Standard errors for each estimate are reported in parenthesis. Asterisks indicate the significance of each estimate (p-value < 0.1^{*}, < 0.05^{**}, < 0.01^{***}).

Table E.5: Linear Regressions on "Offer" (US Data)

	[1]	[2]	[3]	[4]	[5]	[6]
AE	0.2	0.4	0.2	0.2	-0.2	0.2
	(3.3)	(3.4)	(3.3)	(3.3)	(3.3)	(3.4)
Risk Averse	5.8					5.4
	(3.7)					(3.9)
Prosocial		-2.3				-1
		(3.4)				(5.1)
Inequality Averse			2.9			3.1
			(4.4)			(6.1)
Competitive				1.7		1.3
				(5.1)		(6.6)
Male						-1.9
						(3.5)
Invest					3.7	3.6
					(3.3)	(3.4)
Constant	45^{***}	51^{***}	49^{***}	49^{***}	48^{***}	45^{***}
	(3.6)	(2.9)	(2.5)	(2.4)	(2.8)	(6.2)

Notes: Estimates are derived from the linear regression $Offer = \beta X + \epsilon$ where our dependent variable is the offer subjects chose as a second mover, X is our matrix of independent variables, and ϵ is a matrix of i.i.d. error terms. Only observations from our US sample are included. Standard errors for each estimate are reported in parenthesis. Asterisks indicate the significance of each estimate (p-value < 0.1^{*}, < 0.05^{**}, < 0.01^{***}).

Table E.6: Linear Regressions on "Reimburse" (US Data)

	[1]	[2]	[3]	[4]	[5]	[6]
AE	-.20**	-.20**	-.20**	-.20**	-.20**	-.19**
	(.08)	(.08)	(.08)	(.08)	(.08)	(.09)
Risk Averse	-.01					.01
	(.09)					(.10)
Prosocial		-.07				-.02
		(.08)				(.13)
Inequality Averse			.10			.09
			(.11)			(.15)
Competitive				.05		.05
				(.13)		(.17)
Male						.05
						(.09)
Invest					-.09	-.08
					(.08)	(.09)
Constant	.49	.52	.47	.48	.53	.47
	(.09)	(.07)	(.06)	(.06)	(.07)	(.16)

Notes: Estimates are derived from the linear regression $Reimburse = \beta X + \epsilon$ where our dependent variable is an indicator equal to 1 if the subject chose an offer greater than or equal to the first mover's cot of investment, X is our matrix of independent variables, and ϵ is a matrix of i.i.d. error terms. Only observations from our US sample are included. Standard errors for each estimate are reported in parenthesis. Asterisks indicate the significance of each estimate (p-value < 0.1*, < 0.05**, < 0.01***).

Table E.7: Linear Regressions on "MWTA" (US Data)

	[1]	[2]	[3]	[4]	[5]	[6]
AE	1.8	1.6	1.5	1.6	2.6	2.4
	(4.1)	(4.1)	(4.1)	(4.2)	(3.4)	(3.4)
Risk Aversion	-3.5					-4.2
	(4.7)					(3.9)
Prosocial		-4.1				-4.5
		(4.2)				(3.8)
Inequality Aversion			5.8			
			(5.8)			
Competitive				-4.4		-6.2
				(6.7)		(6.1)
Male						3.9
						(3.5)
Offer					0.6^{***}	0.5^{***}
					(0.1)	(0.1)
Constant	48^{***}	48^{***}	45^{***}	46^{***}	16^{***}	21^{***}
	(4.6)	(4.0)	(3.1)	(3.1)	(5.8)	(7.1)

Notes: Estimates are derived from the linear regression $MWTA = \beta X + \epsilon = \beta X + \epsilon$ where our dependent variable is the MWTA investing subjects chose as a first mover, X is our matrix of independent variables, and ϵ is a matrix of i.i.d. error terms. The only observations included in each specification are from subjects that both chose to invest and are from our US sample. Standard errors for each estimate are reported in parenthesis. Asterisks indicate the significance of each estimate (p-value < 0.1^{*}, < 0.05^{**}, < 0.01^{***}).

Table E.8: Summary Statistics (China)

	CSE	CAE	p-value
Investment Rate	41/72 = 56.9%	52/96 = 54.2%	(0.720)
Mean Offer	60.5 ECU	56.3 ECU	(0.172)
Reimbursement Rate	49/72 = 68.1%	50/96 = 52.1%	(0.037)
Mean MWTA	57.5 ECU	54.3 ECU	(0.452)

Notes: Means for each strategy chosen by *China* subjects in the hold-up game are reported for each endowment condition. The p-values associated with *Invest* and *Reimburse* are derived from two-sample Fisher's exact tests of proportions with the null hypothesis of equality across endowment conditions. The p-values associated with *Offer (mean)* and *MWTA (mean)* are derived from Welch's *t*-tests.

Table E.9: Earnings and Successful Trade (China)

	SE	AE	Obs.	Clusters	p-value
Δ Group Earnings	-4.2 ECU	-3.4 ECU	168	84	(0.887)
Successful Trade | Invest == 1	58.5%	59.6%	93	69	(0.916)

Notes: China sample means for each variable are reported across endowment conditions. Means for "Δ Group Earnings" are derived from the linear regression $\Delta GroupEarnings_i = \beta_0 * SE_i + \beta_1 * AE_i + \epsilon_i$ where $\Delta GroupEarnings_i$ is the change in group earnings associated with the iteration of the holdup game associated with player *i's* first mover decisions, SE_i is an indicator equal to 1 if player *i* took part in SE, AE_i is an indicator equal to 1 if player *i* took part in AE, and ϵ_i is the standard error clustered by pair. Means for "Successful Trade | Invest == 1" from similar regressions, but only uses observations for which subject *i* chose to invest as a first mover. p-values are derived Wald-tests comparing estimates across endowment conditions.

Table E.10: Risk and Social Preferences (China)

	SE	AE	p-value
Risk Averse	75.0%	73.9%	(0.878)
Prosocial	29.1%	35.4%	(0.393)
Inequality Averse	19.4%	17.7%	(0.774)
Competitive	19.4%	21.8%	(0.701)

Notes: China sample means for each variable across endowment conditions. (p-values are derived two-sample Fisher's exact tests of proportions with the null hypothesis of equality across endowment conditions)

Table E.11: Linear Regressions on "Invest" (China Data)

	[1]	[2]	[3]	[4]	[5]
AE	-0.03	-0.03	-0.03	-0.03	-0.03
	(.08)	(.08)	(.08)	(.08)	(.08)
Risk Averse	0.06				-0.02
	(.09)				(.09)
Prosocial		-0.04			-0.14
		(.08)			(.10)
Ineq. Averse			-0.13		-0.24^{**}
			(.10)		(.11)
Competitive				-0.05	-0.18^{*}
				(.10)	(.11)
Male					-0.2^{**}
					(.08)
Constant	0.53^{***}	0.58^{***}	0.59^{***}	0.58^{***}	0.81^{***}
	(.09)	(.06)	(.06	(.06)	(.12)

Notes: Estimates are derived from the linear regression $Invest = \beta X + \epsilon$ where our dependent variable is an indicator variable for investment, X is our matrix of independent variables, and ϵ is a matrix of i.i.d. error terms. Only observations from our China sample are included. Standard errors for each estimate are reported in parenthesis. Asterisks indicate the significance of each estimate (p-value < 0.1^{*}, < 0.05^{**}, < 0.01^{***}).

Table E.12: Linear Regressions on "Offer" (China Sessions)

	[1]	[2]	[3]	[4]	[5]	[6]
AE	-4.1	-4.2	-4.2	-4.2	-3.8	-3.8
	(3)	(3)	(3)	(3)	(2.8)	(2.9)
Risk Averse	-0.4					0.0
	(3.4)					(3.4)
Prosocial		0.7				1.8
		(3.2)				(3.7)
Ineq. Averse			-3.2			0.0
			(3.8)			(4.3)
Competitive				1.0		2.6
				(3.7)		(4.2)
Male						3.3
						(3)
Invest					12.3^{***}	13.1^{***}
					(2.8)	(3)
Constant	61^{***}	60^{***}	61^{***}	60^{***}	53^{***}	50^{***}
	(3.4)	(2.5)	(2.4)	(2.4)	(2.7)	(5.2)

Notes: Estimates are derived from the linear regression $Offer = \beta X + \epsilon$ where our dependent variable is the offer subjects chose as a second mover, X is our matrix of independent variables, and ϵ is a matrix of i.i.d. error terms. Only observations from our China sample are included. Standard errors for each estimate are reported in parenthesis. Asterisks indicate the significance of each estimate (p-value < 0.1^{*}, < 0.05^{**}, < 0.01^{***}).

Table E.13: Linear Regressions on "Reimburse" (China Sessions)

	[1]	[2]	[3]	[4]	[5]	[6]
AE	-.16**	-.16**	-.16**	-.16**	-.15**	-.15**
	(.08)	(.08)	(.08)	(.08)	(.07)	(.07)
Risk Averse	.07					.10
	(.09)					(.09)
Prosocial		.08				.13
		(.08)				(.09)
Ineq. Averse			-.13			.01
			(.10)			(.11)
Competitive				.06		.14
				(.09)		(.11)
Male						.13*
						(.08)
Invest					.29***	.32***
					(.07)	(.07)
Constant	.63***	.66***	.71***	.67***	.52***	.29***
	(.09)	(.06)	(.06)	(.06)	(.07)	(.13)

Notes: Estimates are derived from the linear regression $Reimburse = \beta X + \epsilon$ where our dependent variable is an indicator equal to 1 if the subject chose an offer greater than or equal to the first mover's cot of investment, X is our matrix of independent variables, and ϵ is a matrix of i.i.d. error terms. Only observations from our China sample are included. Standard errors for each estimate are reported in parenthesis. Asterisks indicate the significance of each estimate (p-value < 0.1*, < 0.05**, < 0.01***).

Table E.14: Linear Regressions on "MWTA" (China Sessions)

	[1]	[2]	[3]	[4]	[5]	[6]
AE	-3.6	-2.8	-3.2	-3.7	-2.6	-2.9
	(4.2)	(4.2)	(4.2)	(4.1)	(4.1)	(4.2)
Risk Aversion	3.3					4.9
	(4.9)					(5)
Prosocial		-5.9				-5.0
		(4.5)				(5.1)
Ineq. Aversion			-1.7			0.3
			(5.8)			(6.4)
Competitive				10.6		9.4
				(5.1)		(5.8)
Male						3.4
						(4.4)
Offer					0.2*	0.2^{*}
					(0.1)	(0.1)
Constant	55^{***}	59^{***}	58^{***}	56^{***}	43^{***}	36^{***}
	(4.7)	(3.3)	(3.2)	(3.2)	(9.2)	(10.6)

Notes: Estimates are derived from the linear regression $MWTA = \beta X + \epsilon = \beta X + \epsilon$ where our dependent variable is the MWTA investing subjects chose as a first mover, X is our matrix of independent variables, and ϵ is a matrix of i.i.d. error terms. The only observations included in each specification are from subjects that both chose to invest and are from our China sample. Standard errors for each estimate are reported in parenthesis. Asterisks indicate the significance of each estimate (p-value < 0.1^{*}, < 0.05^{**}, < 0.01^{***}).

Table E.15: Cross Country Comparisons (Strategies)

	$H_0: CSE - USE = 0$	$H_0: CAE - UAE = 0$
Invest	11.36%	-0.5%
Offer	10.65 ECU**	6.40 ECU**
Reimburse	19.53%**	23.96%***
MWTA	12.00 ECU**	6.97 ECU*

Notes: Estimated test statistics compare values across treatment conditions with asterisks indicating their significance (p < 0.1^{*}, < 0.05^{**}, < 0.01^{***}). Estimates associated with *Invest* and *Reimburse* are derived from a two-sample Fisher's exact test of proportions. Each estimate associated with *Offer* or *MWTA* are derived from Welch's *t*-tests.

Table E.16: Cross Country Comparisons (Earnings and Successful Trade)

	$H_0: CSE - USE = 0$	$H_0: CAE - UAE = 0$
Δ Group Earnings	0.7 ECU	-1.5 ECU
	(0.900)	(0.740)
Successful Trade | Invest == 1	3.7%	-3.3%
	(0.754)	(.645)

Notes: Estimated test statistics are derived from linear regressions using the first and second mover decisions from each subject. Standard errors are clustered by pair, and p-values are reported in parentheses.

Table E.17: Cross Country Comparisons (Risk and Social Preferences)

	US	China	p-value
Risk Averse	70.8%	74.4%	(0.743)
Prosocial	58.33%	32.7%	(0.000)
Inequality Averse	15.6%	18.4%	(0.687)
Competitive	12.1%	20.8%	(0.017)

Notes: China sample means for each variable across endowment conditions. p-values are derived two-sample Fisher's exact tests of proportions with the null hypothesis of equality across endowment conditions.

Table E.18: Linear Regressions on “Invest” (Cross Country Comparisons)

	[1]	[2]	[3]	[4]	[5]	[6]
China*SE	.11	.11	.11	.12	.12	.08
	(.08)	(.08)	(.09)	(.08)	(.08)	(.09)
China*AE	-.01	-.01	.00	.00	.00	-.04
	(.08)	(.08)	(.08)	(.08)	(.08)	(.08)
Risk Av.		.05				.00
		(.07)				(.07)
Prosocial			.00			-.09
			(.06)			(.08)
Ineq. Av.				-.09		$-.19^{**}$
				(.08)		(.09)
Comp.					-.08	$-.17^{*}$
					(.08)	(.09)
Male						$-.16^{***}$
						(.06)
AE	.09	.09	.09	.09	.09	.09
	(.09)	(.09)	(.09)	(.09)	(.09)	(.09)
Constant	$.46^{***}$	$.42^{***}$	$.45^{***}$	$.47^{***}$	$.46^{***}$	$.67^{***}$
	(.06)	(.08)	(.07)	(.06)	(.06)	(.11)

Notes: Standard errors are reported in parentheses. Asterisks indicate significance ($p < 0.1^{*}$, $< 0.05^{**}$, 0.01^{***}).

Table E.19: Linear Regressions on "Offer" (Cross Country Comparisons)

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
China*SE	10.6^{***}	10.6^{***}	10.6^{***}	10.6^{***}	10.5^{***}	9.7^{***}	10.0^{***}
	(3.2)	(3.2)	(3.3)	(3.2)	(3.3)	(3.2)	(3.3)
China*AE	6.4^{**}	6.4^{**}	6.3^{**}	6.4^{**}	6.2^{**}	6.4^{**}	7.0^{**}
	(3.1)	(3.1)	(3.2)	(3.1)	(3.1)	(3)	(3.1)
Risk Av.		2.4					2.9
		(2.5)					(2.5)
Prosocial			-0.4				1.5
			(2.3)				(2.9)
Ineq. Av.				0.5			3.5
				(2.9)			(3.5)
Comp.					1.7		4.1
					(3)		(3.5)
Male							3.2
							(2.1)
Invest						8.5^{***}	9.5^{***}
						(2.2)	(2.2)
AE	0.1	0.2	0.2	0.1	0.1	-0.7	-0.8
	(3.3)	(3.3)	(3.4)	(3.3)	(3.3)	(3.3)	(3.3)
Constant	49.8^{***}	48.0^{***}	50.0^{***}	49.7^{***}	49.6^{***}	45.9^{***}	39.4^{***}
	(2.3)	(3)	(2.6)	(2.4)	(2.3)	(2.5)	(4.3)

Notes: Standard errors are reported in parentheses. Asterisks indicate significance ($p < 0.1^{*}$, $< 0.05^{**}$, 0.01^{***}).

Table E.20: Linear Regressions on "Reimburse" (Cross Country Comparisons)

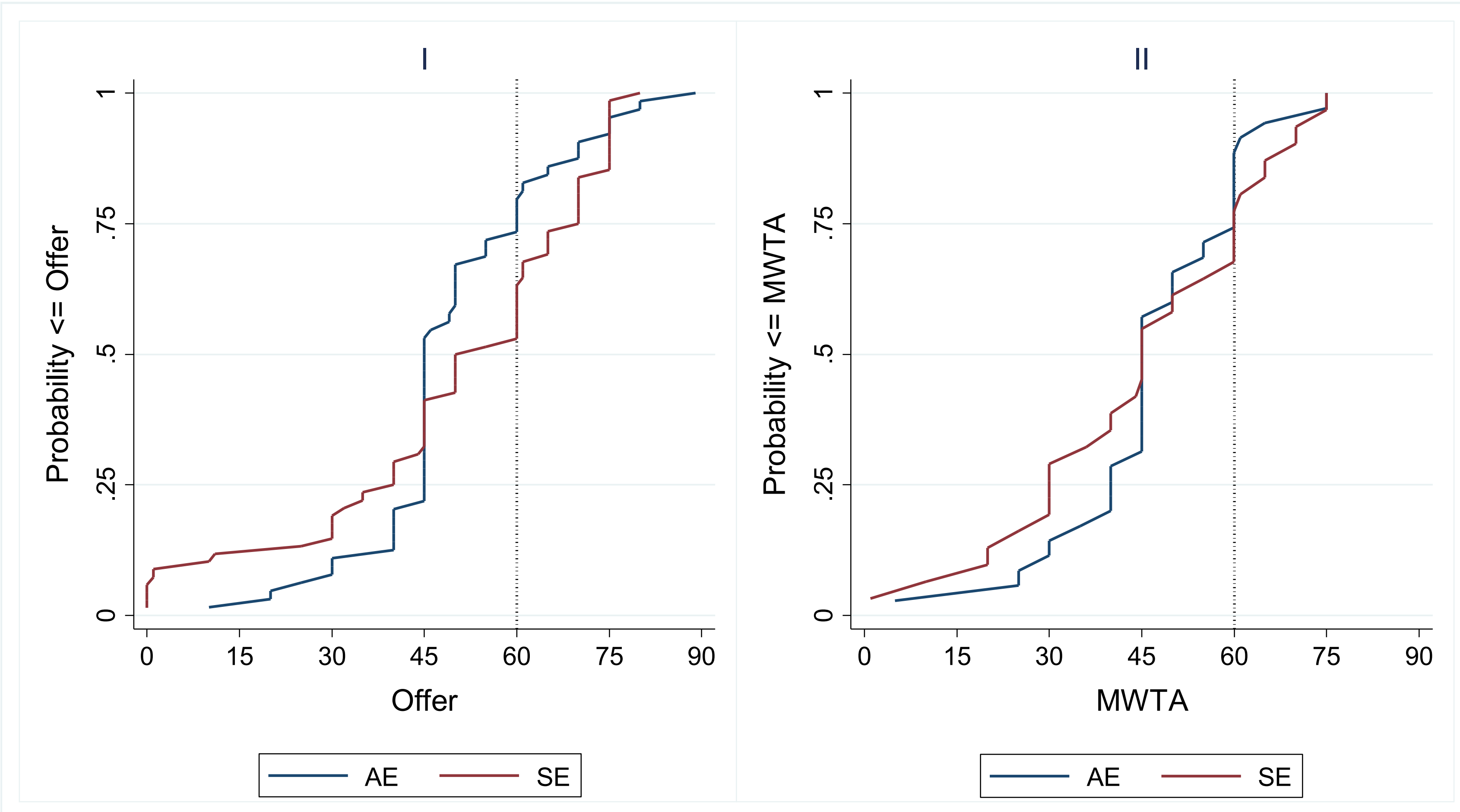
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
China*SE	.20**	.19**	.20**	.20**	.19**	.18**	.20**
	(.08)	(.08)	(.08)	(.08)	(.08)	(.08)	(.08)
China*AE	.24***	.24***	.24***	.24***	.23***	.24***	.27***
	(.08)	(.08)	(.08)	(.08)	(.08)	(.08)	(.08)
Risk Av.		.04					.07
		(.06)					(.06)
Prosocial			.02				.07
			(.06)				(.07)
Ineq. Av.				-.02			.07
				(.07)			(.09)
Comp.					.08		.14
					(.08)		(.09)
Male							.14**
							(.05)
Invest						.12**	.16***
						(0.06)	(.06)
AE	-.20**	-.20**	-.21**	-.20**	-.20**	-.22**	-.22**
	(.08)	(.08)	(.08)	(.08)	(.08)	(.08)	(.08)
Constant	.49***	.46***	.48***	.49***	.48***	.43***	.21***
	(.06)	(.08)	(.07)	(.06)	(.06)	(.06)	(.11)

Notes: Standard errors are reported in parentheses. Asterisks indicate significance ($p < 0.1^{*}$, $< 0.05^{**}$, 0.01^{***}).

Table E.21: Linear Regressions on "MWTA" (Cross Country Comparisons)

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
China*SE	12.0^{***}	12.0^{***}	10.2^{**}	12.0^{***}	11.1^{**}	7.2^{*}	5.6
	(4.4)	(4.5)	(4.5)	(4.5)	(4.4)	(4.4)	(4.6)
China*AE	7.0^{*}	7.0^{*}	5.8	7.0^{*}	6.0	2.7	1.6
	(4.1)	(4.1)	(4.1)	(4.1)	(4.1)	(4)	(4.1)
Risk Av.		0.3					1.2
		(3.5)					(3.3)
Prosocial			-5.1				-4.8
			(3.1)				(3.6)
Ineq. Av.				1.4			0.3
				(4.2)			(4.6)
Comp.					8.0^{*}		6.0
					(4.2)		(4.6)
Male							3.1
							(2.8)
Offer						0.4^{***}	0.4^{***}
						(0.1)	(0.1)
AE	1.8	1.8	1.6	1.7	1.6	2.3	1.9
	(4.6)	(4.6)	(4.6)	(4.6)	(4.6)	(4.4)	(4.4)
Constant	46^{***}	45^{***}	49^{***}	45^{***}	45^{***}	26^{***}	26^{***}
	(3.4)	(4.2)	(3.8)	(3.4)	(3.3)	(5.6)	(6.8)

Notes: Standard errors are reported in parentheses. Asterisks indicate significance ($p < 0.1^{*}$, $< 0.05^{**}$, 0.01^{***}).



Notes: Panel I plots the *US* distribution of *Offer* for each endowment condition. Panel II plots the *US* distribution of *MWTA* for each endowment condition.

Figure E.1: Distribution of Offers and MWTA (US)

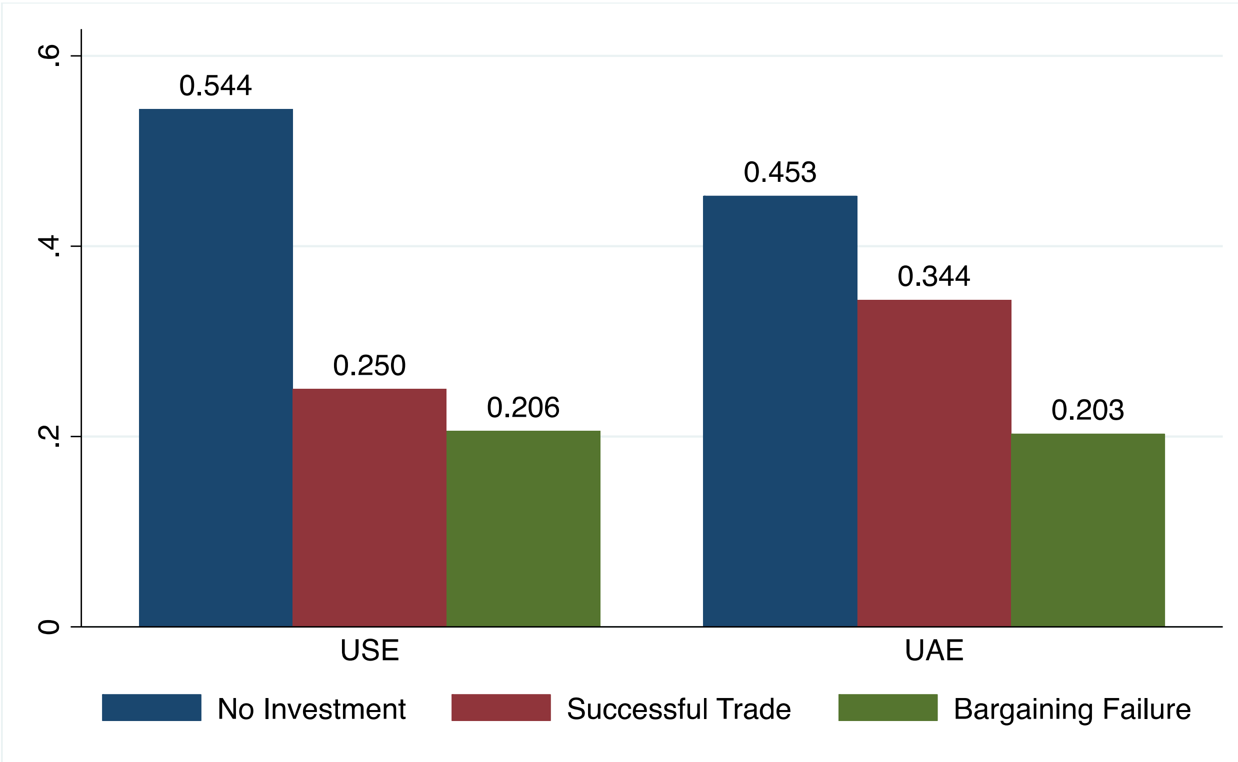
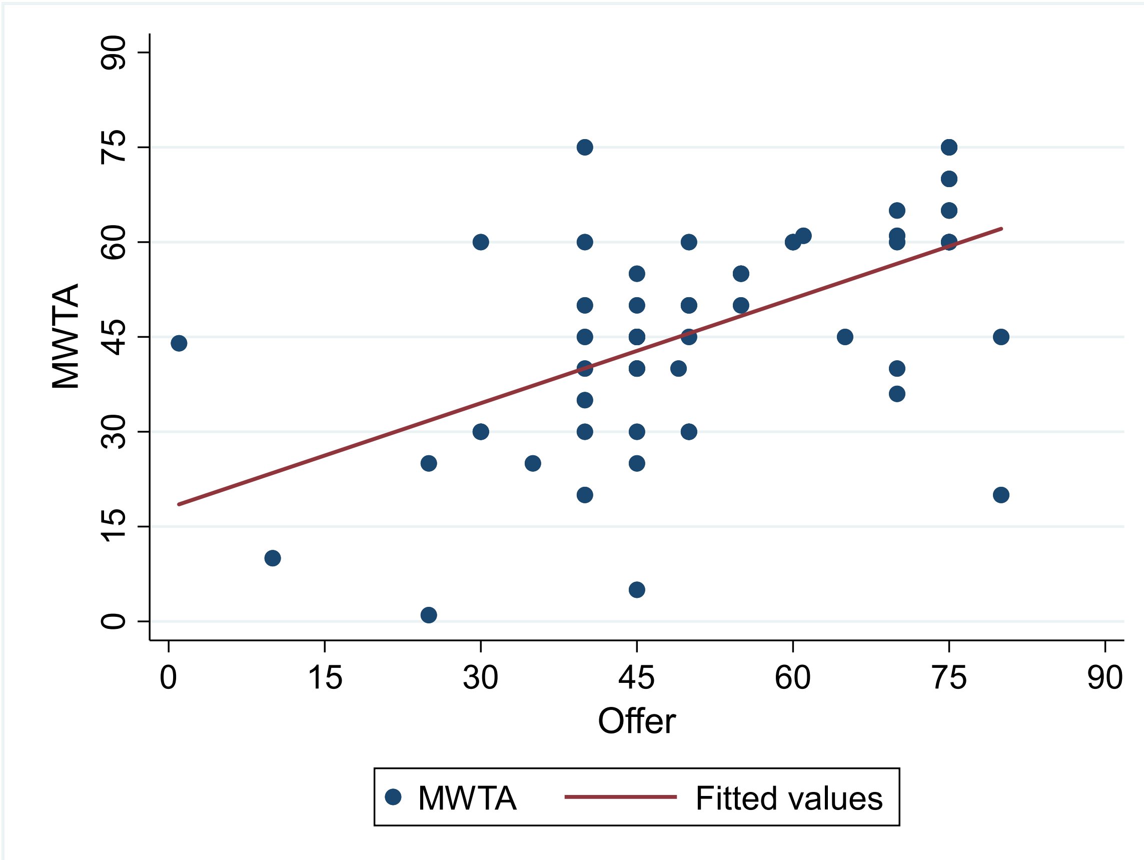
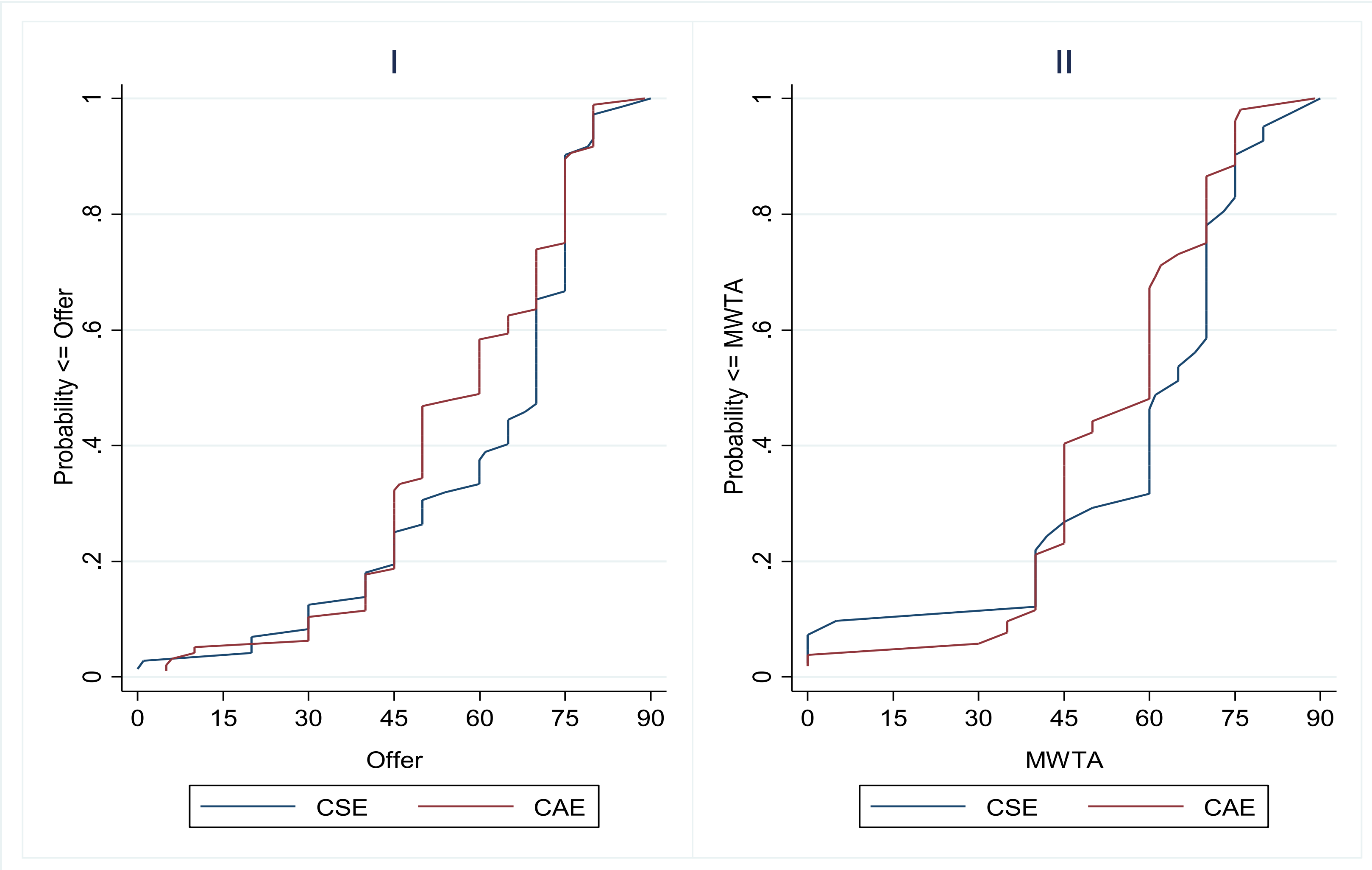


Figure E.2: Hold-up Game Outcomes (US)



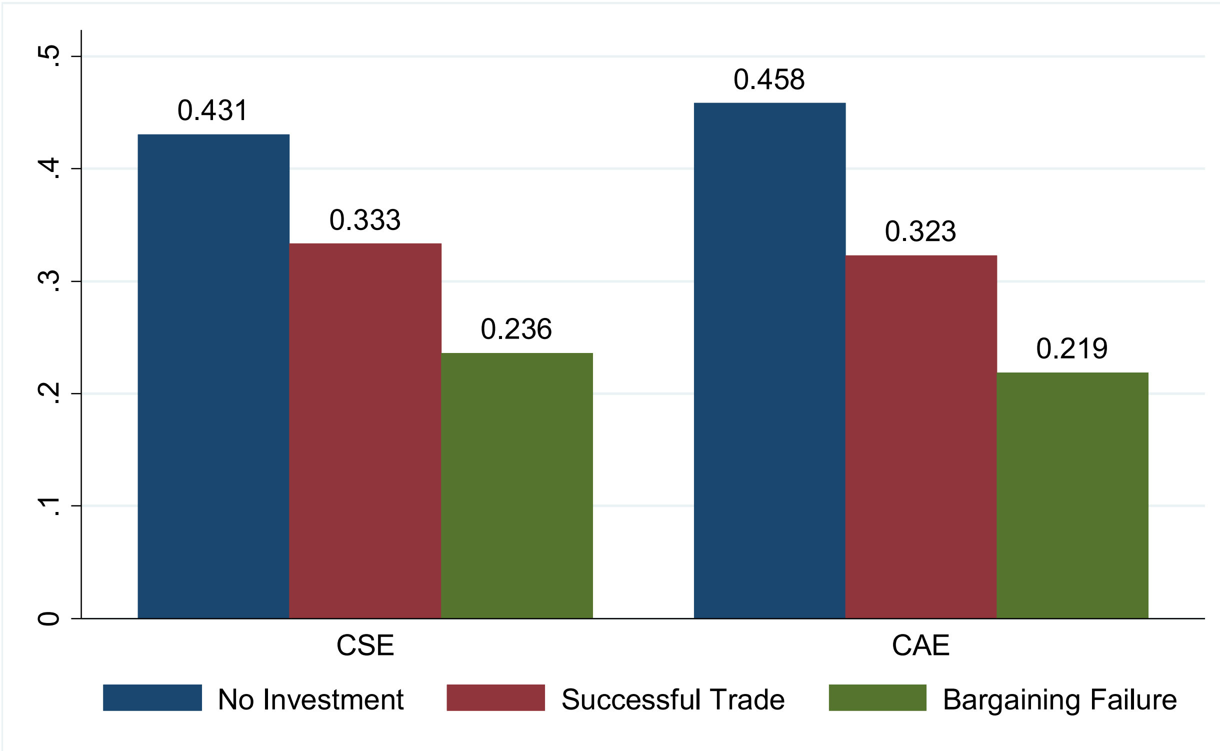
Notes: Two-way scatter plot of *MWTA* conditional on *Offer* for *US* subjects. “Predicted *MWTA*” plots a fractional polynomial with *Offer* as the only independent variable.

Figure E.3: MWTA Conditional on Offer (US)



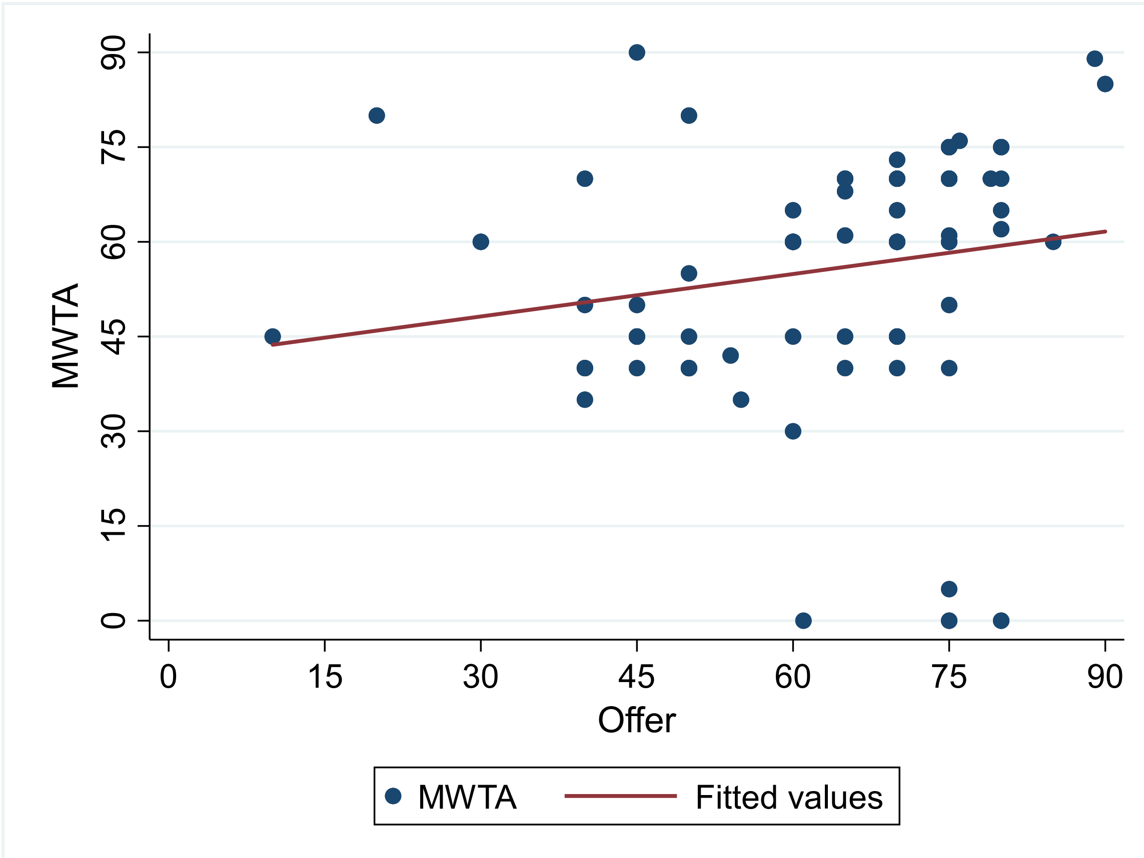
Notes: Panel I plots the *China* distribution of *Offer* for each endowment condition. Panel II plots the *China* distribution of *MWTA* for each endowment condition.

Figure E.4: Distribution of Offers and MWTA (China)



Notes: The *China* distribution of hold-up game outcomes are plotted above.

Figure E.5: Hold-up Game Outcomes (China)



Notes: Two-way scatter plot of *MWTA* conditional on *Offer* for *US* subjects. “Predicted *MWTA*” plots a fractional polynomial with *Offer* as the only independent variable.

Figure 6: MWTA Conditional on Offer (China)

APPENDIX B: ADDITIONAL TABLES AND FIGURES

Table F.1: Endowment Conditions (SE, FH, and SL)

	SE	AE-FH	AE-SL
ω_1	100	160	100
ω_2	100	100	40

Notes: The table reports endowments provided to first and second movers across endowment conditions. "SE" denotes our symmetric endowment condition. "AE-FH" denotes our asymmetric endowment conditions in which the first mover's endowment is increased relative to SE. "AE-SL" denotes our asymmetric endowment conditions in which the second mover's endowment is decreased relative to SE.

Table F.2: US Data (FH and SL)

	FH	SL	p-value	K-S
Invest	59.37%	50.00%	(0.451)	--
Offer	50.34	49.50	(0.603)	(0.999)
Reimburse	28.15%	28.15%	(1.00)	
MWTA	48.74	45.62	(0.289)	(0.408)

Notes: Means for each strategy chosen by subjects in the hold-up game are reported above. Estimated test statistics compare values across treatment conditions with asterisks indicating their significance ($p < 0.1^{*}$, $< 0.05^{**}$, $< 0.01^{***}$). Each estimate associated with *Invest* is derived from a two-sample Fisher's exact test of proportions. Each estimate associated with *Offer* or *MWTA* are derived from two-sample Mann-Whitey rank-sum tests.

Table F.3: China Data (FH and SL)

	FMH	SML	p-value	K-S
Invest	56.25%	52.08%	(0.686)	--
Offer	56.17	56.47	(0.997)	(0.979)
Reimburse	52.08%	52.08%	(1.00)	
MWTA	54.29	54.28	(0.927)	(0.695)

Notes: Means for each strategy chosen by subjects in the hold-up game are reported above. Estimated test statistics compare values across treatment conditions with asterisks indicating their significance ($p < 0.1^{*}$, $< 0.05^{**}$, $< 0.01^{***}$). Each estimate associated with *Invest* is derived from a two-sample Fisher's exact test of proportions. Each estimate associated with *Offer* or *MWTA* are derived from two-sample Mann-Whitey rank-sum tests.

Table F.4: China and US Data (FH and SL)

	H_0: CFH = UFH	H_0: CSL = USL
Invest	(0.785)	(0.857)
Offer	(0.050)	(0.047)
Reimburse	(0.034)	(0.034)
MWTA	(0.419)	(0.038)

Notes: p-values from estimated test statistics compare values across treatment conditions and are reported in parentheses. Each estimate associated with *Invest* is derived from a two-sample Fisher's exact test of proportions. Each estimate associated with *Offer* or *MWTA* are derived from two-sample Mann-Whitey rank-sum tests.

Table F.5: Risk Elicitation (Essay 3)

Lottery Number	High Payoff (ECU)	Low Payoff (ECU)	Chances (High, Low)	US (%)	China (%)
1	56	56	(50%, 50 %)	4.5	4.2
2	72	48	(50%, 50 %)	9.1	17.3
3	88	40	(50%, 50 %)	30.3	24.4
4	104	32	(50%, 50 %)	28.8	28.6
5	120	24	(50%, 50 %)	12.1	15.5
6	140	4	(50%, 50 %)	15.2	10.1

Notes: Subjects were instructed to choose 1 of the 6 lotteries listed above. The degree of constant relative risk aversion (CRRA) associated with each lottery is as follows: [Lottery 1 | $3.46 < r$], [Lottery 2 | $1.16 < r < 3.46$], [Lottery 3 | $0.71 < r < 0.16$], Lottery 4 | $0.50 < r$, 0.71], Lottery 5 | $0 < r < 0.50$], [Lottery 6 | $r < 0$]. Variable '*Risk Averse'* = 1 if Lottery 1, 2, 3, or 4 was chosen.

Table F.6: Social Preference Elicitation (Essay 3)

Decision Number	Option A (Self, Other)	Option B (Self, Other)	US (% Option B)	China (% Option B)
1	(48, 48)	(48, 24)	14.4	27.3
2	(48, 48)	(48, 32)	18.9	34.5
3	(48, 48)	(48, 40)	18.9	43.5
4	(48, 48)	(48, 56)	66.7	48.8
5	(48, 48)	(48, 64)	65.2	39.9
6	(48, 48)	(48, 72)	63.6	34.5

Notes: Subjects were instructed to state whether you prefer Option A or Option B for each row. Variable '*Competitive'* = 1 if the subjects chose Option B for Decisions 1-3 and Option A for Decisions 4-6. Variable '*Prosocial'* = 1 if the subjects chose Option A for Decisions 1-3 and Option B for Decisions 4-6. Variable '*Inequality Averse'* = 1 if the subjects chose Option A for Decisions 1-6.

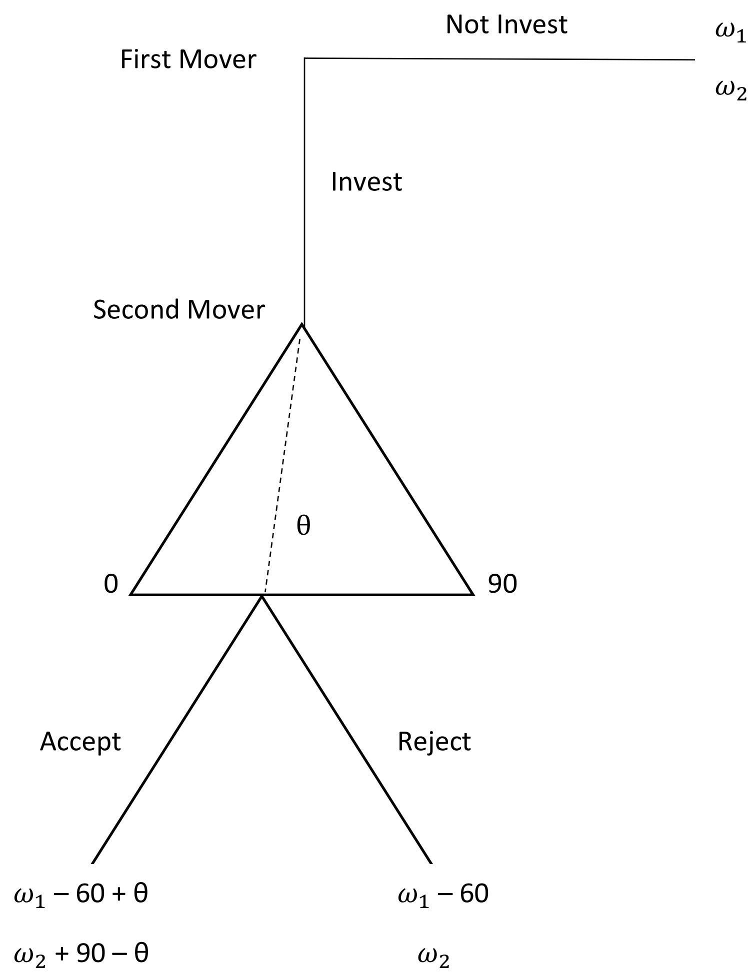
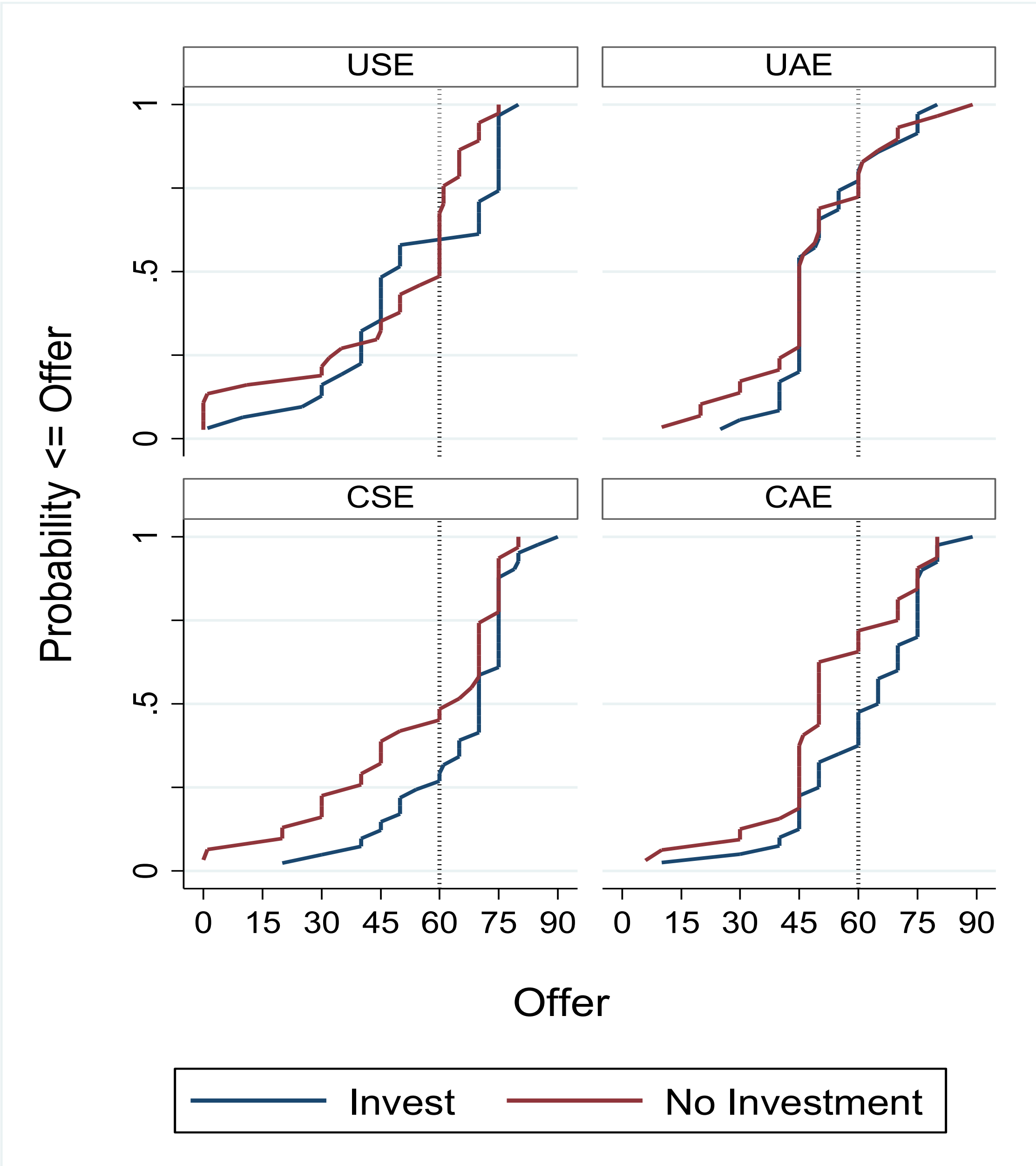


Figure F.1: Extended Form Game Tree of the Hold-Up Game



Notes: Figure B.2 plots the distribution of *Offer* conditional on investment decision in each treatment.

Figure F.2: Offer Distributions and Investment

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